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The purpose of this 3-day conference was to review relevant completed research in industrial arts and to identify priority research areas. It was attended by 15 teacher educators from universities which offer doctoral programs and three representatives from the Center for Vocational and Technical Education. During the opening day, completed research was reviewed through presentations by individuals. The second day was devoted to the identification of research needs, and on the last day these needs and methods for achieving the research goals were discussed. Included is a three dimensional "Model of a System Analysis for Classification of Research in Industrial Arts" which was developed at the conference, covering inquiry methods, educational processes, and student groups. Content selection, instructional factors, and instructional evaluation emerged as recommended research areas. The appendix includes a discussion and annotated bibliography of staff and nondegree research, an analysis of "Review and Synthesis of Research in Industrial Arts," and an annotated bibliography of 336 doctoral theses from 1955-1968. (EM)

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Leadership Series No. 20

national conference on research in industrial arts

THE CENTER FOR VOCATIONAL AND TECHNICAL EDUCATION
THE OHIO STATE UNIVERSITY 1900 Kenny Rd., Columbus, Ohio, 43210

VT008591

The Center for Vocational and Technical Education has been established as an independent unit on The Ohio State University campus with a grant from the Division of Comprehensive and Vocational Education Research, U. S. Office of Education. It serves a catalytic role in establishing consortia to focus on relevant problems in vocational and technical education. The Center is comprehensive in its commitment and responsibility, multidisciplinary in its approach, and interinstitutional in its program.

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FINAL REPORT
ON A PROJECT CONDUCTED UNDER
PROJECT NO. 7-0158
GRANT NO. OEG-3-7-000158-2037

NATIONAL CONFERENCE ON RESEARCH IN INDUSTRIAL ARTS

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PURDUE UNIVERSITY

FOR

THE CENTER FOR VOCATIONAL AND TECHNICAL EDUCATION
THE OHIO STATE UNIVERSITY • 1900 KENNY ROAD
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APRIL 1969

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U. S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

OFFICE OF EDUCATION
BUREAU OF RESEARCH

PREFACE

A common problem confronting various elements of the education profession is the establishment of priorities for research and development. Hopefully, consensus on research priorities emanating from a conceptual framework should greatly enhance the possibility that individual research and development projects will provide an incremental input to a cumulative knowledge base.

Recognizing the need for a national professional conference on research in industrial arts education, Ralph Bohn, while president of the American Industrial Arts Association, and W. R. Miller, Membership Committee representing the Division of Industrial Arts of the American Vocational Association, met with Center personnel to identify alternative approaches and to plan for a national research planning conference. The Center for Vocational and Technical Education sponsored this meeting on October 15-17, 1968. The purpose of this conference was to review relevant completed research in industrial arts and to identify priority research areas. Such priorities established by a national professional committee should provide guidance to graduate students and others interested in undertaking research and development activities in this substantive area.

Special recognition should be given for the work of Alan R. Suess who compiled the conference report and to W. R. Miller, Jerry Streichler and Daniel Householder for their papers and research compilations which provided the springboard for the conference discussion.

A. J. Miller of The Center staff served as coordinator of this project and was responsible for final editing.

Robert E. Taylor
Director
The Center for Vocational
and Technical Education

FOREWORD

The task of summarizing and reporting the outcomes of any conference is a risky undertaking. In the first place, there is always the risk of subjectivity. The author of a conference report may be unduly influenced by his prior attitudes and opinions. Secondly, it is impossible to report and summarize the entire contents of any conference, so biases may enter as a result of inclusions and/or exclusions. Finally, the acceptance or rejection of outcomes by the profession may help or haunt a conference report author for several years.

Faced with the realities of the situation and equipped with more fortitude than good judgment, this task has been undertaken with a great deal of pleasure. The cooperation between the several associations and agencies that gave birth to this conference make the risks worthwhile. Perhaps industrial arts has come of age. The positive and constructive reactions of the conference participants makes one feel that this is the case.

The success of any conference depends on the cooperation of all involved. I wish to take this opportunity to acknowledge the efforts that made the conference and this report possible. The professional vision of Ralph Bohn, Rutherford Lockette and W. R. Miller cannot be overlooked. The cooperation and help given by Robert E. Taylor, A. J. Miller, Edward J. Morrison and the rest of the Center staff made the planning and conduct of this conference an enjoyable task. A great deal of credit for the successful start to the conference go to the individuals who prepared the working papers for the first day of the conference. W. R. Miller's comprehensive review of the nondegree research identified research thrusts that seldom get into the literature. The insightful analysis by Jerry Streichler was most appreciated due to the short notice he had regarding the presentation. Finally, a special note of thanks to Daniel L. Householder for the tremendous amount of effort involved in collecting and synthesizing the doctoral research abstracts.

Alan R. Suess

West Lafayette, Indiana
March 31, 1969

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NATIONAL CONFERENCE ON RESEARCH IN INDUSTRIAL ARTS

OCTOBER 15, 16, 17, 1968

NATIONAL CONFERENCE ON RESEARCH IN INDUSTRIAL ARTS

OCTOBER 15, 16, 17, 1968

THE CONFERENCE

This conference was the first conference exclusively devoted to problems associated with industrial arts education coordinated by The Center for Research and Leadership Development in Vocational and Technical Education (hereafter called The Center). While this fact alone is important, a more important series of events led to the planning and conduction of the conference. This conference was the result of a joint effort by several professional organizations serving industrial arts and industrial arts teacher educators.

Original impetus for the conference resulted from the efforts of the Research Committee of the Industrial Arts Division of the American Vocational Association. W. R. Miller, a member of that committee, was successful in securing the cooperation of the American Industrial Arts Association, The American Council on Industrial Arts Teacher Education, and the National Association of Industrial and Technical Teacher Educators in the development of a proposal for a research conference.

During the early months of 1968, a conference dealing with the problems and issues related to research in the field of industrial arts was suggested to The Center. In February 1968, Ralph Bohn, representing the American Industrial Arts Association, Rutherford Lockette, representing the Industrial Arts Division of the American Vocational Association and the American Council on Industrial Arts Teacher Education, and W. R. Miller, representing the National Association of Industrial and Technical Teacher Educators met with the director of The Center, Robert Taylor, and members of his staff to plan the details of the conference.

As a result of this planning meeting, it was possible to invite a small group of representatives of the institutions offering doctoral work related to industrial arts education. These participants represented institutions that are responsible for producing a major portion of the research related to industrial arts education.

Following the final planning of the conference, Alan R. Suess was invited to serve as conference co-chairman with W. R. Miller. His responsibilities included the detailed planning necessary to identify and invite the participants, develop the working agenda, and write the final report.

Preliminary planning for the conference was aimed at gathering comprehensive information regarding the "state-of-the-art" of research related to industrial arts education. Three basic sources were used to set the climate for the early sessions of the conference. Jerry Streichler was invited to present his reactions to trends, needs, and voids in the research related to industrial arts as a result of the perspective gained as author of the first *Review and Synthesis of Research in Industrial Arts Education*. Information from a literature search and a direct mail questionnaire of non-degree and/or staff research was reviewed by W. R. Miller. This information updated the nondegree research output in industrial arts education for the period of January 1965 to June 1968.[2] Doctoral dissertations completed at the participants' institutions during the period 1955-1968 were abstracted by Daniel L. Householder. These presentations served as working papers for the conference participants. All three papers may be found in the Appendices of this report.

The working agenda developed for the conference was titled a "tentative agenda." The agenda was called tentative because no precedent had been set to guide the formulation of an agenda. A second reason for labeling the agenda "tentative" was the small group size and the pre-conference rapport of the participants. These two factors virtually insured a free-wheeling conference that was likely to deviate from any fixed schedule.

The conference agenda provided for a review of research completed in industrial arts education during the opening session. The second day was used to identify research needs. The final day was reserved for general discussion of the needed research in the field and methods of achieving the research goals.

The free-wheeling nature of the conference makes definitive statements of the central theme of the conference difficult, if not impossible. Regardless of the topic under consideration, however, the central concern of the conference participants kept returning to problems associated with content selection in industrial arts. In some cases this concern was expressed directly. "What is the content and scope of industrial arts in the high school?" In other instances, small group discussions revealed the almost universal concern voiced by classroom practitioners regarding the relevance of traditional industrial arts content and organizational patterns. These discussions led to discussion of change modes, articulation of content and objectives and mechanisms for evaluating instruction. The impact of funded research on industrial arts related projects also shared a central position in the discussions.

A second general, though less persistent, concern of the conference participants was the academic preparation of researchers

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[1] Streichler, Jerry. *Review and Synthesis of Research in Industrial Arts Education*. Columbus, Ohio: The Center for Research and Leadership Development in Vocational and Technical Education, The Ohio State University. August 1966.

[2] See: Fuzak, John A. "Research by Industrial Arts Teacher Education," in Van Tassel, R. (ed.) *Research in Industrial Arts Education*. 9th Yearbook of the American Council on Industrial Arts Education. Bloomington, Ill.: McKnight, 1960.

See also: Miller, W. R. "Staff Studies and Other Non-Degree Research in Industrial Arts Teacher Education," in Rowlett, J. D. (ed.) *Status of Research in Industrial Arts*. 15th Yearbook of the American Council on Industrial Arts Teacher Education. Bloomington, Ill.: McKnight, 1966.

in industrial arts. Discussion repeatedly returned to the four general research classifications (descriptive, historical, philosophical, and experimental) and concern for the adequacy of preparation of graduate students as future researchers in each of these areas.

One factor stood out in the deliberations of both small groups and in the general discussion sessions. There was an emphatic reluctance of the conference participants to categorize and order the research needs in industrial arts. This is not to say that the participants thought there were not problem areas which were more important than other areas. The central concern was the enormity of the need for research in industrial arts coupled with the dirth of qualified and interested researchers in the field.

The following "position paper" presented as a summary by the second discussion group[3] probably summarizes the typical concerns of most of the conference participants. Any attempt at editing the report summary would do serious damage to the continuity of the statement. For that reason, it is included in its entirety.

> It would be highly desirable to specify the network of critical variables which define the field of industrial arts education. Such a network (probably developed through systems analysis techniques) would provide a conceptual model for organizing and directing research in the field. It could be instrumental, along with improved communication and increased research capabilities, in securing the *voluntary* coordination of research efforts. The network, however, cannot be created at a conference, nor will it spring full-blown into existence. Its genesis may reveal only the gross elements of its skeleton, requiring continuous research for further elaboration and explication.
>
> Any attempt at this time to coordinate the efforts of researchers which envisions an imposed focus of effort should be seriously questioned. We cannot afford to reduce the probability of significant progress in any problem areas by inhibiting the relatively few researchers in the field from giving full range to their creative ideas. The major problem in the field is not the lack of coordination, but is lack of good research and researchers.
>
> Until a research model can be developed which identifies the prerequisite in the order in which information is required, it should be remembered that priority lists of research problems (or problem areas) reflect the opinions, at a given time, of a specific (usually limited) group. In light of the great need for research in *all* problem areas of industrial arts; it is much more critical to progress in the field that researchers pursue their *creative* formulations of or approaches to research problems in *any* problem area than it is to channel their more routine efforts to high priority areas.

---

[3] Discussion group participants are listed in Appendix C.

> However, we recognize the usefulness of the periodic publication of priority lists by public funding agencies. It is extremely important that advisory groups, representative of the field, be involved in the development of those priorities.

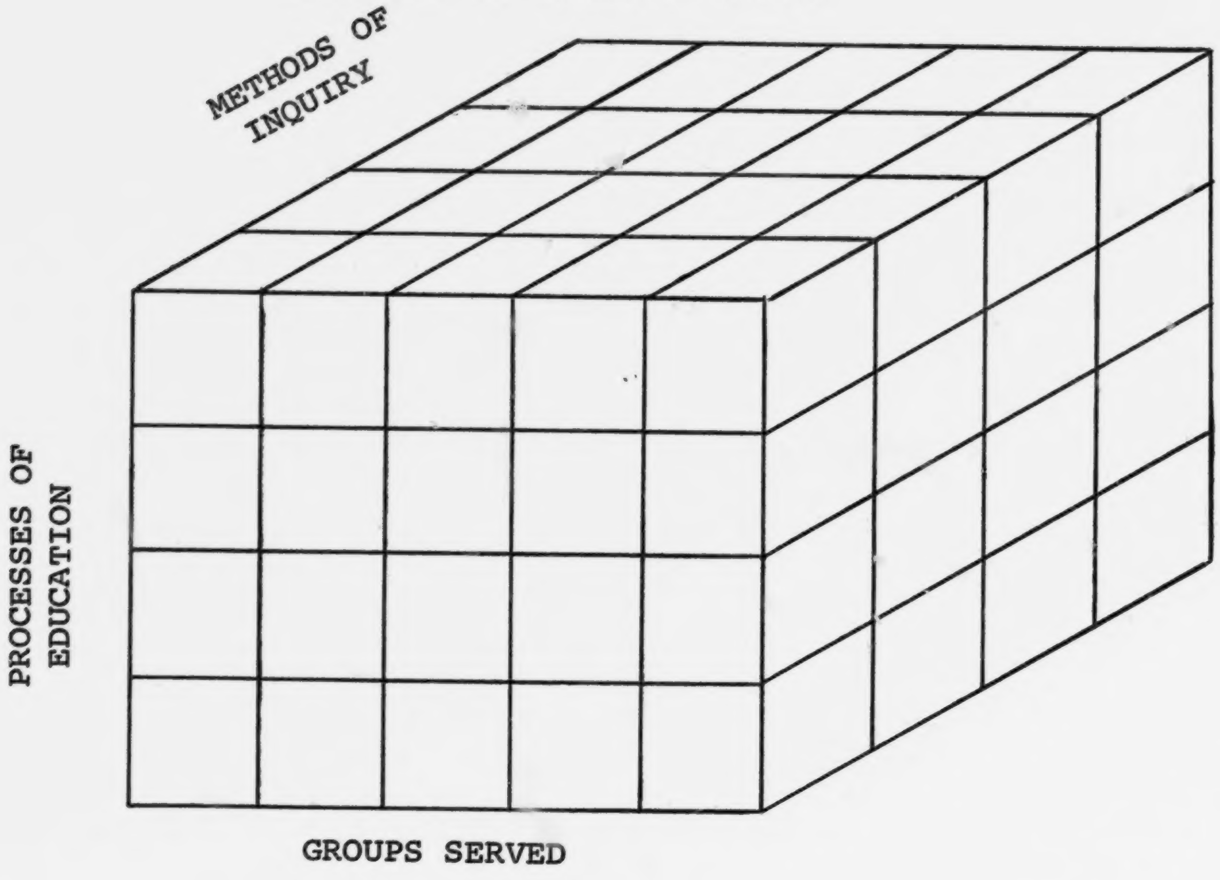
The reader will note that there are several concerns listed in the discussion group summary statement. A brief, but chronological, look at other major points of all discussion groups will reveal that while the participants were concerned about the risks in identifying priorities and citing definitive needs, the discussions of each group really did center on many major problems and researchable topics facing the contemporary industrial arts program. The reader should keep in mind that all groups were meeting simultaneously. This is an important consideration when looking at the similarity between the discussion group reports.

The first group to report to the conference prefaced their comments by expressing concern for retaining the element of free choice in the selection of research topics. The concern was that significant research is followed to completion only when the needs and interests of the researcher are also being met. It was the opinion of this group that free choice is particularly important for young researchers embarking on their first research effort.

Although this position was challenged, it was used as a basic justification for the structure and rationale for a research model for industrial arts. The model is shown in Figure 1. Following

Figure 1

MODEL OF A SYSTEMS ANALYSIS FOR CLASSIFICATION OF RESEARCH IN INDUSTRIAL ARTS



a good deal of discussion the group agreed that the most important use of the tentative model was as a method of classification of potential and completed studies. For this reason, the author has taken the liberty of retitling the model by adding "Classification of" to the original title. The model received enthusiastic support from the group as a whole and was the source of a good deal of discussion. The rationale for the model included a carefully developed set of categories for the X, Y, and Z axes of the model. These possible categories are reproduced, as presented, in Table 1, Table 2, Figure 2, Table 3, and Figure 3.

Table 1

POSSIBLE CATEGORIES IN A SAMPLE ANALYSIS
FOR THE X AXIS
"GROUPS SERVED"

Groups Served

A. Levels
B. Interests
C. Abilities
D. Needs
E. *Other*

Table 2

POSSIBLE CATEGORIES WITHIN THE SAMPLE ANALYSIS FOR THE
"GROUPS SERVED" COLUMN ON THE X AXIS

Sub-Class Levels

1. Industrial Arts - K-6
2. Industrial Arts - 7-9
3. High School-Avocational - I. A.
4. High School - Advanced Study - I. A.
5. High School - Entering Work - I. A.
6. High School - Practical Work - I. A.
7. High School - Basic Skills - I. A.
8. College - General Education - I. A.
9. College and University - Industrial Arts Teacher Education
10. Industrial Arts - Adult

Figure 2

POSSIBLE CATEGORIES IN A SAMPLE ANALYSIS FOR THE Y AXIS "PROCESSES OF EDUCATION"

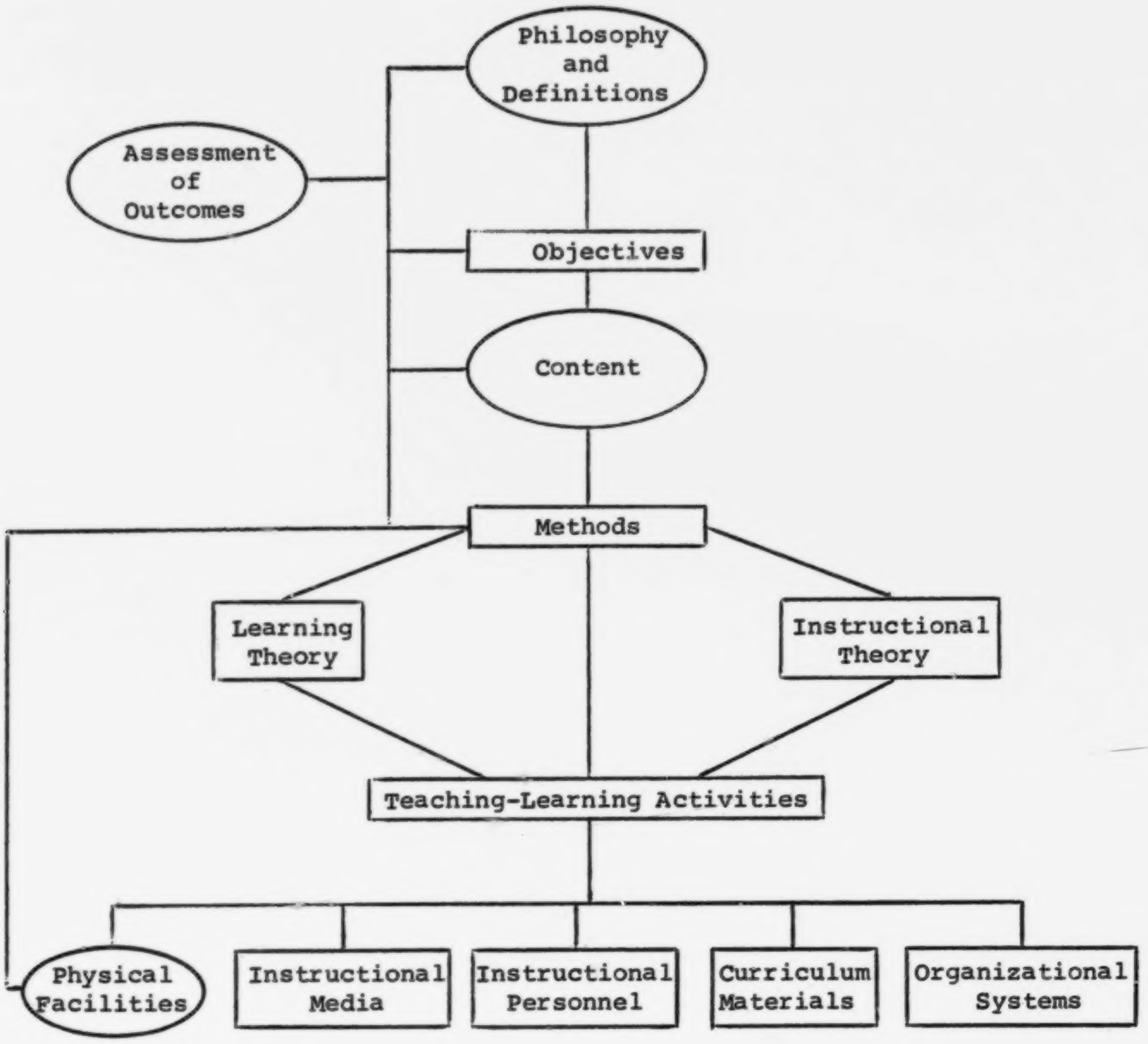

Philosophy and Definitions
Assessment of Outcomes
Objectives
Content
Methods
Learning Theory
Instructional Theory
Teaching-Learning Activities
Physical Facilities
Instructional Media
Instructional Personnel
Curriculum Materials
Organizational Systems

Table 3

POSSIBLE CATEGORIES IN SAMPLE ANALYSIS FOR
THE Z AXIS
"METHODS OF INQUIRY"

A. Experimental

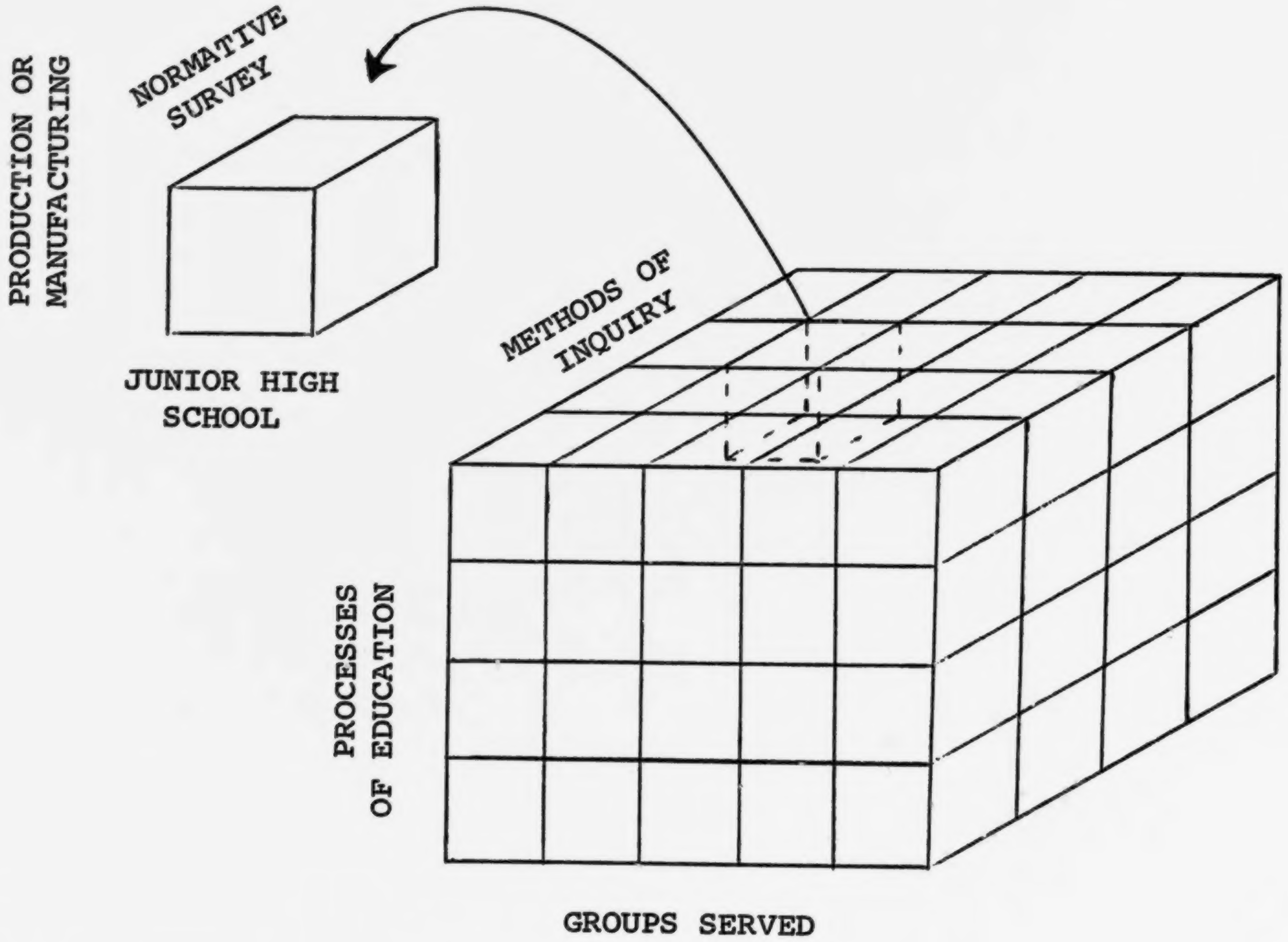
B. Historical

C. Descriptive

D. *Other*

Figure 3

EXAMPLE OF A SINGLE CELL IN THE ANALYSIS MODEL


PRODUCTION OR MANUFACTURING
NORMATIVE SURVEY
JUNIOR HIGH SCHOOL
METHODS OF INQUIRY
PROCESSES OF EDUCATION
GROUPS SERVED

The group, having produced a straw man, had to withstand the sharpshooting of the conference participants. For example, there was brief discussion of the mixture of first and second order categories in the single cell example (see Figure 3). In its pure form the first order analysis would be junior high school/content/descriptive studies. The second order would be seventh grade/production/normative survey studies. Several other minor comments were made regarding the model. Nevertheless, the model served as a bench mark for most of the discussion for the remainder of the conference.

The potential of a research model for industrial arts education led to a great deal of discussion. The many uses of such a model were discussed by the conference participants. Its use as a classification scheme to identify research completed and research needed received a good deal of attention. Comments regarding the large volume of closely related, but totally independent, research reported by D. L. Householder in the digest of dissertation research pointed to the need for such a model. It was pointed out that the only part of the model unique to industrial arts was the "Y" axis. Additional axes were suggested. For example, time is missing in the preliminary model.

Discussion returned to the priority areas for research in industrial arts. Several suggestions were made regarding the need for social priorities. The profession has not addressed itself to such problems as the characteristics of industrial arts in today's secondary schools. The unique needs of the disadvantaged, the reluctant learner, and the gifted student, must be studied. Concern was also expressed for the lack of a categorical system such as is common in the sciences. This system, coupled with a research model, could place real priorities in terms of needed research.

At this point a definition was proposed for the purpose of education. "The purpose of education is an *outcome* which is defined in accordance with an analysis of needs, desires, and aspirations." Assuming this is the case, then research activities within any discipline should be able to answer the following questions:

- What are the differences between outcomes?
- What should the differences be?
- What are the conditions which will transform a particular kind of student into this sort of outcome?
- What student differences need to be dealt with in instruction?
- What are the varieties of conditions which will work on the students to produce these outcomes?

In other words, "objectives, when stated in behavioral terms, are the content."

This comment stimulated a good deal of discussion regarding the goals for industrial arts. Several conference participants suggested that the goals for industrial arts recently published by the American Vocational Association[4] represent a basis for wide variety of research projects.

Following a substantial amount of discussion, it was generally agreed that these goals of industrial arts education are probably most appropriate for developmental studies which identify and define content. These same goals are of limited use in the development of studies which concentrate on determining the optimum conditions for application and transfer of content learned in the activity-oriented environment of the industrial arts classroom.

Group Two presented a summary of their discussions with an opening comment about the inherent risk in establishing rigid priority schemes to direct the research efforts of the profession. Discussion quickly moved to what is a major problem for all disciplines in the vocational, technical, and practical arts spectrum. Doctoral programs have a research requirement and a limited number of research oriented courses. The primary emphasis, however, is college teaching. The result is the well-known lack of qualified researchers in industrial arts. The early part of the group presentation revolved around a proposal for the establishment of research-oriented and a teaching-oriented program.

The need for a research-oriented graduate program was carefully justified. A major point during the discussion was the fact that contemporary developments are revealing the benefits derived from simulated teaching throughout an undergraduate program rather than the one-shot student teaching situation common for many years. The analogy between the emphasis on distributed practice in teacher education programs and the need for more than one piece of research in a graduate program was vigorously made.

Another key point made to justify the establishment of a research-oriented graduate program was the wide-scope research needs facing industrial arts. The critical shortage of research specialists will become increasingly critical as large scale funding results in additional research projects. The short- and long-range effects of these new programs must be evaluated by competent researchers if the funds are to be used wisely as the projects leave the developmental stages and enter the evaluative trial period. Involvement by beginning researchers on a limited scale in many of these areas would introduce the prospective research specialist to several types of research methodology and hopefully eliminate the need for "forced" channeling of research efforts in areas of immediate need.

Recent developments have greatly facilitated the basis for research-oriented graduate programs. Research Coordinating Units in occupational education, the ERIC system, establishment of regional centers for research in occupational education, increased availability of computers, etc., have provided a groundwork for such a program of studies.

One of the high priority tasks for a core of specially prepared researchers in industrial arts would be the development of a model for organizing and directing research in the field. Such a model would make it possible for specialists at several institutions to voluntarily isolate and study a portion of the larger problems identified through the model.

---

[4] See: *A Guide to Improving Instruction in Industrial Arts.* Washington: American Vocational Association, 1968.

At this point, discussion returned again to the earlier discussion of whether the profession could continue to progress with a voluntary research effort. The question was compared to the socialist-democratic value structure. At what point does a profession consider the rights of the individual and when does the profession as a whole need the efforts of the specialists in the solution of the problems of the profession regardless of the interests of the specialists. Discussion terminated rather quickly when one of the group making the presentation suggested that this was a moot question. The lack of qualified researchers in the field precludes this situation arising in the forseeable future.

Increasing the pool of qualified researchers would allow the profession to attack problems on several levels. Important problems must be solved which are important nationally, regionally, institutionally, and professionally in addition to the typical problems at the classroom level which has been the traditional realm of research in industrial arts. Increased emphasis on inter-institutional cooperation was also discussed as a possible answer to the wide range of research needs.

By the time Group Three reported their discussions, it began to sound like a broken record. For example, this group reported that they had spent time trying to evolve a model for research. Unlike the earlier group, they reported no success after reaching the point of listing the four basic types of research (descriptive, historical, philosophical and experimental) and dichotomizing the focus of the studies into student-centered and content-centered studies.

Justification for a research classification model was made on the basis of the total lack of coordination of research efforts within industrial arts. The limited instances of related studies with a unified effort at isolating a problem area and the long term systematic investigation of the problem were noted. The uncoordinated duplication apparent in the abstracts of dissertations completed was noted again.

The group spent a good share of its time looking at the research implications of recent developments in industrial arts. The problems of preservice and inservice teacher education programs in light of the curriculum efforts currently being undertaken were identified. These concerns were highlighted by the frequently expressed concern of classroom teachers regarding the relevance of current content and methods in industrial arts education.

The group attempted to classify some of the important problem areas which need attention if progress is to continue in industrial arts. These areas include:

- The evaluation and synthesis of curriculum innovation proposals and projects. Can common elements be identified in an attempt to determine how to use these elements and where to use them?

- What is the content of industrial arts at its various levels? The funded curriculum projects have emphasized the need for investigation of the unique needs at all levels from elementary school to adult education.

- What is the impact of educational technology on the content and method of industrial arts?
- What, if any, are the educationally unique contributions of industrial arts?
- Can industrial arts contribute to solution of the problems of the post-secondary school age drop-out?
- What conditions lead to the optimum time efficiency organization of content and activities for contemporary industrial arts programs?

Enumeration of the above research areas made the report of this group somewhat unique in that their recommendations achieved a level of specificity greater than that achieved by either of the other two groups. Yet, when the recommendations are carefully evaluated it becomes apparent that the same concerns are being expressed by this group as were expressed by the earlier groups.

The conclusion of the small group reports and discussion of the reports by the conference participants left this author with an interesting dilemma. The discussion at both the small group and conference level had unquestionably been extremely valuable to the participants. These discussions had identified several important research areas and had done much to place the problem areas in a reasonably well-defined hierarchy. The problem was that the participants represented only a small fraction of the potential researchers in industrial arts. The conference had not been called for their enlightenment, but had been called because of the involvement of the participants in directing doctoral research and the potential this had for identifying problem areas for a large number of researchers in the field.

Faced with the need for a more definitive statement of research needs than had resulted from conference proceedings to date, the author began the final day of the conference by requesting a forced choice ranking of research needs in industrial arts. The participants were asked to list the four most important research needs in industrial arts and rank these problems by giving the highest priority area a one rating and the lowest a rank of four. The results of this forced choice ranking are reported in Table 4. The author assumes full responsibility for the risks involved in categorization and the possibility of biasing the intent of the participants which result in any classification and synthesis. Table 4 represents the fifth attempt to summarize the results of the survey. Quite frankly, some of the topics which are reported in the Methods category were in the Content classification during earlier attempts at organizing the results of the survey. Many of the "efficiency of instructional procedures" problems are heavily dependent on content selection procedures and results. Similarly, many of the Methods problems depend heavily on the extent to which learning and instruction can be evaluated. Nevertheless, Table 4 represents the author's judgment of the *intent* of the problem area as ranked by the participants.

Earlier classification attempts had an "Other" category. Careful evaluation of the topics in this category made it possible to move all but the topics related to Teacher Education to other categories. The interest in teacher education which is apparent

Table 4

SUMMARY OF FORCED CHOICE RANKING OF RESEARCH NEEDS IN INDUSTRIAL ARTS

	RANK				
	#1	#2	#3	#4	Total
CONTENT					
What is the body of knowledge?	7	5	3	2	17
What is the content for disadvantaged students?	-	-	1	1	2
Will a historical analysis of content selection methods assist in contemporary content selection?	-	-	-	1	1
					20
METHODS					
How can curriculum change be implemented?	2	-	-	-	2
What instructional procedures are most efficient?	3	3	2	4	12
How can content be made more transferrable?	-	1	-	-	1
How can safety be taught?	-	1	-	-	1
What support systems improve instruction?	-	-	1	2	3
					19
EVALUATION					
Have stated goals been met?	-	1	3	1	5
					5
RESEARCH MODELS					
Can a research classification model be developed?	1	-	1	1	3
					3
TEACHER EDUCATION					
How can undergraduate industrial arts teacher education programs be improved?	-	1	1	1	3
What is an appropriate inservice teacher education program?	-	-	1	-	1
Can a research oriented doctorate be developed?	-	-	1	-	1
					5
TOTAL	13	13	13	13	52

from the survey was an unexpected result. Although a considerable amount of time was spent discussing the characteristics of a research-oriented doctoral program, no mention had been made of other teacher education problems during the discussion periods.

SUMMARY AND RECOMMENDATIONS

Careful review of conference notes, evaluation of the ranking of the research needs by the conference participants, and a review of the tape recordings of all discussion periods make the following conclusion appear warranted.

The most important task facing industrial arts is continued research related to content selection at all levels. Conference discussions, research priority rankings, and small group reports all have an overriding concern for the implications of content selection for industrial arts. The impact of the funded curriculum projects in industrial arts was noted by several participants. Another common point made during the conference was the dissatisfaction with traditional content being expressed in all regions by classroom teachers at all levels of public school programs. The lack of commonly accepted objectives for industrial arts also points to the critical need for research in content selection. The research rankings indicate a need for study of such widely diverse areas as the elementary school, the disadvantaged, the several types of students who take industrial arts in the high school, as well as the more general problem of what exactly is the domain of industrial arts.

New approaches to classroom instruction must be developed. The digest of doctoral research (see Appendix F) is filled with "methods" studies. At the present time the industrial arts profession does not need any more Method A versus Method B studies. There is a critical need, however, for studies which evaluate the extent to which desired outcomes can be obtained with a given method. The advent of new curricular arrangements moves industrial arts away from a strictly activity-oriented instructional program. It is no longer possible (if it ever was) to teach the content of industrial arts using a lathe or a circular saw. New approaches to content selection also move the realm of the instructional materials outside the four walls of the classroom. This will increase the need for models, mock-ups, simulation devices and effective use of audio-visual aids and devices. As content increases the question of instructional efficiency assumes new importance. The need for streamlined classroom procedures that still produce the desired outcome are becoming increasingly important. Increased attention must be given to the implications of innovations in all of education. The instructional problems raised by individually prescribed instruction, modular scheduling, increased availability of closed circuit television, videotape recording apparatus, and other technological and instructional innovations must become part of the research effort of the industrial arts profession.

Increased attention must be given to the evaluation of instruction. Recent emphasis on "measurable objectives" and "goal-oriented instruction" must become a major research concern for industrial arts. The assessment of the effect of instruction is certainly a "chicken-and-egg" problem. The need for articulated study in content selection and research into efficient and effective instructional modes both require meaningful evaluation of the quantity and quality of learning that result from curricular and instructional innovations. There is a critical need to evaluate both the innovative programs and the existing programs. Positive change can occur most effectively when individuals are aware of deficiencies in existing programs. It is difficult, if not impossible, to convince a practitioner to change his program without being able to demonstrate the weaknesses in the existing programs. This task will not be easy in a profession long accustomed to evaluating an end product in isolation of the relevance of that product to the "real world." Failure of the safety "lobby" to convince the general public of the need for seat belts probably emphasizes the need for more than "facts" to change behavior. The implications for increased efforts in terms of improving evaluation techniques as a positive factor in improving instructional efficiency and content revision cannot be overlooked.

The three basic recommendations just made imply hundreds of research projects. No profession can progress when research activity is conducted in deliberate or accidental ignorance of the efforts and thrust of the remainder of the profession. While it may be true that the history of science and invention is filled with simultaneous independent invention, the inventions were possible because the literature in the field had led the researchers in the direction of fruitful discovery. Classification schemes, uniform vocabularies, professional cooperation, and coordinated attacks on important problem areas have led science to accomplishments that even fiction writers could not imagine.

Change is going to occur in industrial arts. The 1968 amendments to the Vocational Education Act of 1963 will change the face of industrial arts. The money, effort, and general quality of the funded and unfunded curriculum revision efforts will continue to change industrial arts. The pressures from special interest groups, federal, state, and local government agencies, and "educational divisions" of major corporations have already made marked changes in the content and procedures used in industrial arts. The need to take fresh looks at researchable areas and the strategies for conducting the research are as important as the research itself.

There are many "sacred cows" within the areas of content, method, and evaluation. There will unquestionably be many risks in terms of accomplishing positive change as a result of research efforts in these three general areas. Similarly, advanced cases of "mind-set" may make imaginative research proposals very difficult to evolve.

In conclusion, the author of this report shares the reluctance of the conference participants in citing specific research needs. There are so many related problems that demand solution that it is impossible to give them priorities. For example, no specific recommendation has been made in this section regarding the problems that advances in content and method have for industrial arts teacher education. If one of the problems facing all of education is how to get inservice teachers to change their instructional offerings to meet changed conditions, then there is certainly a need for study of methods to prepare teachers for the inevitability of change and a willingness to adjust to change. Ultimately, this is both a content and method problem. Does this mean that research in change modes should follow articulation of the change? Perhaps this is a problem which is prior to the change problem. In any event, the problem must be investigated and solved if possible.

The insights and overview which have resulted from the planning, conducting, and reporting of this conference have led this report writer to a few definite conclusions. First, the industrial arts profession must prepare for change. The concern for careful definition of the body of knowledge, model building and systems analysis, and the content selection which results from such activity, expressed by a large portion of the conference participants is a sure indication that change will occur. Changes in content demand changes in instructional mode. Considerations regarding researchable topics must change with changes in content and method. In the opinion of this writer, research studies which attempt to compare technique A with technique B are required only after *each* technique has been fully developed. This may require several studies designed to improve the efficiency of each technique before any attempt is made at a comparison of techniques. This implies, no--it demands, a coordinated look at problem areas. It requires a long-term commitment by an individual or a cooperative effort by several researchers. The lack of progress apparent in the research digest associated with this paper gives mute evidence to the deficiencies of current efforts.

APPENDICES

APPENDIX A

TENTATIVE AGENDA

TUESDAY, OCTOBER 15, 1968

9:00 a.m.	Welcome to "1900 Kenny Road" *--Robert E. Taylor*
9:15 a.m.	Genesis of the Conference *--W. R. Miller*
9:30 a.m.	Report on staff research and provision for continuing report staff research studies *--W. R. Miller*
10:00 a.m.	Coffee Break
10:15 a.m.	Analysis of the first *Review and Synthesis of Research in Industrial Arts* *--Jerry Streichler*
11:30 a.m.	Lunch
1:00 p.m.	Overview of conference procedures *--Alan Suess*
1:30 p.m.	Discuss "Digest of Selected Doctoral Research in Industrial Arts Education 1955-1968" by D. L. Householder *--Alan Suess*
2:00-4:45 p.m.	Break into small groups for discussion of research completed

WEDNESDAY, OCTOBER 16, 1968

8:00 a.m.	Continued small group discussions "Looking into the Research Needs"
9:30 a.m.	Coffee Break

WEDNESDAY, OCTOBER 16, 1968 (CONT.)

9:45 a.m.	Continued small group discussion
11:30 a.m.	Lunch
1:00 p.m.	ERIC and Research in Industrial Arts --*Emmett Mason* ERIC Document Analyst for Industrial Arts
1:30-4:30 p.m.	General Discussion of Small Group Conferences --*Edward J. Morrison*

THURSDAY, OCTOBER 17, 1968

8:00 a.m.	General discussion of research priorities and strategies
9:30 a.m.	Coffee Break
11:30 a.m.	Adjourn

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Dr. Edward J. Morrison--Research Coordinator

APPENDIX C

DISCUSSION GROUP PARTICIPANTS

GROUP 1

--David Bjorkquist
--Rutherford Lockette
--W. R. Miller
--Willis Ray
--Raymond Van Tassel

GROUP 2

--Walter Brown
--David Jelden
--Jerome Moss
--Jacob Stern
--Jerry Streichler

GROUP 3

--Everett Glazener
--Joseph Luetkemeyer
--Harold Silvius
--Alan Suess
--Larry Wright

STAFF STUDIES AND OTHER NONDEGREE RESEARCH IN INDUSTRIAL ARTS EDUCATION

by *W. R. Miller*
Associate Professor of Industrial Education
The University of Missouri

INTRODUCTION

The quality and quantity of nondegree research in industrial arts education has been a matter of concern to professional industrial educators since a study conducted by Fuzak[1] revealed a totally inadequate level of organized research effort on the part of industrial educators. A more recent study by Miller[2] revealed a brighter picture with regard to nondegree research in industrial arts education; however, in view of the large number of unsolved problems in the field at that time, the research activities of industrial arts educators were still inadequate in relation to the tremendous need.

Since the aforementioned studies by Fuzak and Miller revealed a generally inadequate level of nondegree research, it was decided to replicate their investigations for the period January 1965, to June 1968. The results of this investigation, which are reported in the remainder of this paper, are encouraging though far from adequate. While a fewer number of studies were identified when compared to Miller's investigation, there is nonetheless cause for optimism because the period of time involved was considerably shorter. Thus, industrial arts educators appear to be aware of the need for increased research activity and are becoming more actively engaged in it. In spite of the improved status of nondegree research, there remains considerable room for improvement. It is obvious from the current level of nondegree research that the profession has not wholly accepted its responsibilities with regard to the extention of the boundaries of knowledge in industrial arts education.

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[1] John A. Fuzak. "Research by Industrial Arts Teacher Education," in Van Tassel, R. (ed.) *Research in Industrial Arts Education.* 9th Yearbook of the American Council on Industrial Arts Education. Bloomington, Ill.: McKnight, 1960, Chapter 3.

[2] W. R. Miller. "Staff Studies and Other Non-Degree Research in Industrial Arts Teacher Education," In Rowlett, J. D. (ed.) *Status of Research in Industrial Arts.* 15th Yearbook of the American Council on Industrial Arts Teacher Education. Bloomington, Ill.: McKnight, 1966, Chapter 6.

APPENDIX D

IDENTIFICATION OF PROFESSIONAL RESEARCH

The procedure followed in the identification of nondegree research and staff studies was identical to that followed by Miller in that both professional literature as well as a survey of the institutions listed in the *Industrial Teacher Education Directory*[3] were utilized.

The major sources reviewed in the research identification process were: *The American Vocational Association Journal*, *The Industrial Arts and Vocational Education Magazine*, *The School Shop Magazine*, and *The Journal of Industrial Teacher Education*. The review of these sources was limited to the period from January 1965 to June 1968. This review was further limited to reports which gave evidence of a systematic structure, a description of the purpose and procedures, an indication of findings as well as a statement of conclusions and generalizations resulting from the research effort.

The reviewing process identified 10 research studies that met the previously mentioned criteria. Of these 10 studies, the vast majority were reported in the *Journal of Industrial Teacher Education*. Thus, this publication continues to be a major source of research information of interest to industrial educators.

The survey identified 10 studies that met the established criteria, as well as provided information relative to research projects underway, but not completed, and research projects that were in preliminary stages of planning. A great many studies were identified through the use of the survey that were not included in this report because they were primarily concerned with vocational-industrial education.

NON-DEGREE RESEARCH SINCE JANUARY 1965

The completed studies identified through the combination of procedures previously described vary considerably with regard to topic studied as well as rigor of the investigating and reporting procedures followed.

Several of the studies were staff or team efforts; however, complete data regarding all participants were not provided. Therefore, while one or two individuals may be cited with the study for identification purposes, several others may have contributed materially to the study.

INDUSTRIAL ARTS TEACHER EDUCATION

Research which had as its purpose the consideration of the development and/or improvement of the program or practice of industrial arts teacher education is herein identified. Except where noted otherwise, the best source for further information regarding the research study would be the principal investigator cited.

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[3] G. S. Wall, (Compiler), *Industrial Teacher Education Directory*, (Stout State University, Menomonie, Wisconsin, 1967).

Dennis, Ervin A.: Stout State University, Menomonie, Wisconsin.
A study to ascertain the present status of industrial arts effectiveness toward the accomplishment of selected objectives. The objectives examined were: 1) interest in industry, 2) health and safety, and 3) orderly performance (1967). Reported in the *Journal of Industrial Teacher Education,* Vol. 4, No. 3, 1967.

Hatley, Jimmy: Del Valle High School, Del Valle, Texas.
A survey of college drafting department chairmen to compare the performance of college students with high school drafting experience and students with no previous drafting experience (1967). Reported in *Industrial Arts and Vocational Education Journal,* Vol. 56, No. 2, February 1967.

Hoverson, Burton R.: St. Paul Public Schools, St. Paul, Minnesota.
A study to ascertain the effect of a presentation about the objectives and activities of junior high school industrial arts and a project display during an "Open House" on the attitude of parents. The study also attempted to determine the relationship between the current enrollment of a son in an industrial arts course and the attitude of parents toward industrial arts (1967). Reported in the *Journal of Industrial Teacher Education,* Vol. 5, No. 1, 1967.

Huss, William E.: State University College at Oswego, Oswego, New York.
Diffusion of industrial arts innovations through an inservice education program for teachers of industrial arts in New York State. The program that was the focal point of this study was a regional inservice center established at Oswego for the purpose of assisting industrial arts teachers (1965).

Huss, William E.: State University College at Oswego, Oswego, New York.
A study of the preparation of industrial arts teachers for disadvantaged youth in urban areas (1965).

Seitz, James E.: Kansas State College of Pittsburg, Pittsburg, Kansas.
A study of problem solving techniques and developmental activities in industrial arts education, as reflected in periodical literature concerned with industrial arts (1965). Reported in the *Journal of Teacher Education,* Vol. 3, No. 3, 1966.

APPENDIX D

TEACHING METHODS AND MEDIA

The studies identified in this category had as their purpose the improvement of teaching-learning efficiency through the investigation of instructional practices or materials.

Cochran, Leslie H.: Western High School, Detroit, Michigan.
The development and experimental testing of a Skinnerian linear program sequence for teaching lettering in a high school drafting course (1966). Reported in the *Journal of Industrial Teacher Education*, Vol. 3, No. 3, 1966.

Erickson, Richard C.: Purdue University, Lafayette, Indiana.
An experimental investigation of visual-haptic psychological aptitudes upon the teaching-learning process associated with beginning mechanical drawing (1967). Reported in the *Journal of Industrial Teacher Education*, Vol. 4, No. 4, 1967.

Hofer, Armand G., and Bjornerud, James: Stout State University, Menomonie, Wisconsin.
An experimental comparison of video tape instruction and traditional laboratory demonstrations in teaching selected machine woodworking operations. The investitigation involved four sections of a basic woodworking course at Stout State University (1967).

Moeller, Carl A.: North Carolina State University, Raleigh, North Carolina.
An experimental study to ascertain the relative effectiveness of two methods of instruction in the fundamentals of operating an engine lathe. The two methods were the traditional lecture/demonstration and an audio-visual approach utilizing film and taped instructions (1967). Reported in the *Journal of Industrial Teacher Education*, Vol. 4, No. 3, 1967.

Pucel, David J.: University of Minnesota, Minneapolis, Minnesota.
An experimental comparison of the effectiveness of the typical manner of organizing information sheets with organizations based upon the "Subsumption Theory of Meaningful Verbal Learning and Retention" (1966). Reported in the *Journal of Industrial Teacher Education*, Vol. 4, No. 2, 1965.

Shemick, John M.: Pennsylvania State University, University Park, Pennsylvania.
An experimental comparison of written instruction sheets and the "Audio-Graphic" machine for teaching a unit in metal spinning. The "Audio-Graphic" machine is a device which utilizes 35mm slides and magnetic tape recordings in a timed sequence (1965). Reported in *Industrial Arts and Vocational Education Journal*, Vol. 54, No. 8, October 1965.

STATUS AND NEED

Investigations categorized in this section have attempted to ascertain certain conditions, not for purposes of comparison, but to provide a knowledge base upon which to plan future activities.

Collins, Charles J.: West Virginia Institute of Technology, Montgomery, West Virginia.
A survey of industrial arts in the southern appalachian region, 1964-1965 (1968). Financial support provided through the U. S. Office of Education.

Innis, Robert W.: Bowling Green State University, Bowling Green, Ohio.
A survey of industrial arts graduates of Bowling Green State University, 1958 through 1965 (1966).

Innis, Robert W.: Bowling Green State University, Bowling Green, Ohio.
A survey of opinions and attitudes concerning industrial arts as expressed by students majoring in industrial arts at Bowling Green State University (1966).

Runnalls, James J.: Stout State University, Menomonie, Wisconsin.
A followup study of the participants in the NDEA Institute in Plastics held at Stout State University. The major purpose of the study was to ascertain whether or not the participants established instructional programs in plastics in their respective schools as a result of attending the Institute (1968).

Shoemaker, Charles E.: State University College at Oswego, Oswego, New York.
A study to ascertain the distribution of grades of all industrial arts majors in liberal-cultural subjects as a basis for determining those subjects having the greatest affect upon the attrition rate of students. The population for the study consisted of all industrial arts majors enrolled in liberal arts courses for the Spring and Fall Semesters of the 1966 school year, at Oswego State College (1967).

MISCELLANEOUS STUDIES

This category of studies should imply no more than the fact that each research cited represents an area of investigation which has no studies of a similar nature reported; therefore, they have been grouped together for convenience.

Lathrop, Irvin T., and Farr, Wilbur J: Long Beach State College, Long Beach, California.
A study of the relationship of industrial arts education to vocational-technical education in the State of California (1968). Financial assistance provided through Vocational Education Act of 1963.

Rice, Charles M.: Southern Illinois University, Carbondale, Illinois.
A study to trace the descent of genius in the Chippendale family relative to woodworking craftsmanship. Particular emphasis was placed on the life of Thomas Chippendale V, of Vancouver, British Columbia, Canada (1968).

Russell, Samuel E.: Florida A. and M. University, Tallahassee, Florida.
A study of occupational trends in the State of Florida and their impact on programs of industrial education (1967). Reported in the *Journal of Industrial Teacher Education*, Vol. 4, No. 4, 1967.

Moss, Jerome, Jr.: University of Minnesota, Minneapolis, Minnesota.
A study which compared the grades earned in post-secondary vocational industrial education courses by students who had industrial arts in the senior high school with those earned by students who had no senior high school industrial arts experience (1966). Reported by the Minnesota Research Coordination Unit in Occupational Education, Minneapolis, Minnesota.

Moss, Jerome, Jr.: University of Minnesota, Minneapolis, Minnesota.
An investigation of the relationship between the "primary creative abilities" and actual creative performance in a content area of industrial arts. The study attempted to establish the concurrent validity of the Minnesota Test of Creative Thinking as well as relationships between creative abilities and intelligence of eighth grade industrial arts students (1966). Reported as Monograph No. 2 American Council on Industrial Arts Teacher Education, 1966.

NON-DEGREE RESEARCH IN PROCESS

In addition to the preceding studies which were reported as completed, a number of studies were reported "in process." Even though these investigations were reported in a variety of stages, it was decided that their inclusion would be beneficial to the profession.

INDUSTRIAL ARTS TEACHER EDUCATION

Chaplin, Jack W.: San Jose State College, San Jose, California.
A study of industrial arts teacher education programs with implications for new and expanded teacher education programs.

Fowler, Ewell W.: Eastern Illinois University, Charleston, Illinois.

An evaluation of subject matter content of industrial arts machine woodworking as it relates to teacher preparation.

Johnson, Verner B.: Western Illinois University, Macomb, Illinois.
A study of the activities and experiences of industrial arts student teachers.

Mannion, Edward J.: Utah State University, Logan, Utah.
A study to ascertain the informational content necessary for teaching the materials of industry to elementary school children.

STATUS AND NEED

Brightwell, B. Eugene: State Department of Education, Jefferson City, Missouri.
Survey to ascertain the status of industrial arts in the State of Missouri.

Collins, Charlie J.: West Virginia Institute of Technology, Montgomery, West Virginia.
The development and implementation of new industrial arts programs in the public schools of West Virginia.

Johnson, Duane A.: Stout State University, Menomonie, Wisconsin.
A survey to ascertain the course construction, course content, physical facilities, teaching aids, and administrative policies of metals programs offered within the public schools of the State of Wisconsin.

Long, Ralph E.: Utah State University, Logan, Utah.
A followup study of entrants in the Lincoln School Shop Awards Contest.

Perkins, L. H.: University of West Florida, Pensacola, Florida.
A survey to ascertain the status of vocational and practical arts education in the west Florida region.

Storm, John A.: State University of New York at Oswego, Oswego, New York.
A study of the duties and responsibilities of professional personnel serving as department chairmen, directors, supervisors, or administrators of programs of industrial arts in the State of New York.

THE INDUSTRIAL BASE FOR INDUSTRIAL ARTS

Cunningham, B. M.: Bradley University, Peoria, Illinois.
A study to identify the applied sciences in industrial education and industry.

Face, W. R.; Flug, E. R.; and Swanson, R. S.: Stout State University, Menomonie, Wisconsin.
A developmental study designed to identify and structure a body of knowledge interpretive of industry that is expressed in concepts rather than isolated elements of content. This is a continuing investigation; however, a progress report was issued in the Fourteenth Yearbook of the American Council on Industrial Arts Teacher Education. Financial assistance provided through a grant from the Cooperative Research Branch of the United States Office of Education and the Ford Foundation.

Hackett, D. F.: Georgia Southern College, Statesboro, Georgia.
An analysis of the scientific technical knowledge associated with the area of woodworking.

Kirby, Jack: Wisconsin State University--Platteville, Platteville, Wisconsin.
Industriology--The science of industry. Funded by the U. S. Office of Education.

Kleinback, M. H.: Wayne State College, Wayne, Nebraska.
An illustrated study of the operations, processes and products in selected Northeast Nebraska industries.

Melo, Louie: San Jose State College, San Jose, California.
A study to identify and evaluate industrial materials in the secondary school industrial arts program.

Merrill, George R.: University of Maryland, College Park, Maryland.
An evaluative study to ascertain the effectiveness of the "education for industry" program.

Nelson, Orville: Stout State University, Menomonie, Wisconsin.
An investigation to ascertain the effects of the study of American industry. This investigation is a part of the American Industry Project which is funded by the U. S. Office of Education.

Teel, Dean: Eastern Illinois University, Charleston, Illinois.
The development of a common body of knowledge for technology in a system approach for the study of industry.

Towers, Lux, Ray, *et.al:* The Ohio State University, Columbus, Ohio, with the University of Illinois, Urbana, Illinois.
The Industrial Arts Curriculum Project--an investigation of possible approaches to structuring the body of knowledge in industrial technology using advisors representing various related disciplines and agencies. A continuing project funded by United States Office of Education, aiming at developing and implementing a systematic curriculum for industrial arts at the various levels.

MISCELLANEOUS STUDIES

Siegner, C. V.: Peru State College, Peru, Nebraska.
A study of the classroom use of the new high-speed 35mm photographic emulsions.

NON-DEGREE RESEARCH PLANNED

The survey of institutions having programs of industrial arts teacher education yielded information regarding research plans that had been formulated, although the projects had not been initiated.

Due to the nature of planned activities, it was decided that no detailed description would be attempted. Only an indication of the principal areas in which research activities may be anticipated are herein reported.

Fewer studies were reported in the "planning stage" than in either the "completed" or the "in process" categories; only nine studies were currently being planned. Of the planned projects, five were in the area of industrial arts teacher education. Three were in the area of industrial arts curriculum structure and appraisal, and one was in the area of instructional methods and media.

ANALYSIS OF
REVIEW AND SYNTHESIS OF RESEARCH IN INDUSTRIAL ARTS

(Implications and recommendations for researchers and reviewers)

by *Jerry Streichler*, Professor and Chairman
Department of Industrial Education
Bowling Green State University

I have inferred two purposes for this conference. One is that those who have accepted the task to prepare a second "generation" *Review and Synthesis of Research in Industrial Arts* are expected to benefit from the experiences of their predecessor is an important first goal. The other is that conference participants will be called upon to identify research problems in industrial arts--or at least address the problem of improving research in industrial arts.

You are referred to the summary and conclusions of the first *Review and Synthesis of Research in Industrial Arts* where my views regarding the research posture in industrial arts are presented. My remarks, therefore, will be brief and will center on the problems of preparing such a review. However, we shall never be far away from the problems occasioned by research weaknesses in our field. Thus, I am hopeful that this presentation will serve, in part at least, to stimulate a dialogue which will result in: 1) substantive recommendations for future research reviews, and 2) a framework for research or a research policy in the field.

DATA GATHERING

Careful consideration must be given to appropriate lead time for response and followup in any canvass regarding research. While ERIC has been established since the first review was done, one cannot depend upon it as the only information source on research in the field. Anyone preparing a review and synthesis is trying to determine and communicate the "state of the art" and needs information on proposed, inprogress and completed research which may not be Federally funded and hence, may not appear in ERIC. For example, such a canvass produced draft copies of research reports, information which was unavailable except through direct mail contact with the researcher. Therefore, future reviewers may need to establish some sort of communication mechanism for contacting all appropriate agencies to submit copies of completed research reports and status reports on work projected or underway.

The first Review was conducted under a short deadline date which forced this reviewer to make somewhat unrealistic requests of colleagues to obtain needed information. This elicited poor cooperation from many. It was an imposition to request information on such short notice, particularly so near the close of the academic year as in the case of the last Review.

APPENDIX E

ORGANIZATION OF THE MATERIAL

Prior to this project a series of research reviews which were patterned after reviewers in established research journals, appeared in the *Journal of Industrial Teacher Education*. These may have suggested the organization of the first series of reviews and syntheses in vocational and technical education. Reviews currently in such journals are generally devoted to a particular topic--one more clearly delimited than a general review of "Research in Industrial Arts." Future reviews and syntheses should be more than a collection of reviews of research and syntheses catalogued under broad topic areas. There is an inherit danger in such organization. You will agree that much of the research that has been produced in industrial arts and which we *tend* to catalogue under headings like *Philosophy*, or *Administration*, or *Instructional Materials* have implications for many other topics and could be catalogued differently. The strength of a research review and synthesis lies in the manner in which it not only synthesizes the research within a particular area of the field but in the way interrelationships that exist among areas within the field are developed and established. The type of weakness in the classification system used in the past review is that a reader is likely to be directed to the section of the review which in his judgment deals with a particular interest area. However, valuable information contained in another category may be bypassed. It can be argued that most research has a *major* thrust, yet such aspects of the research like the design itself may be appropriate to many categories. Further, not to develop the full implications of research--even beyond those realized by the researchers--and this should be a prime responsibility of future reviewers--denies the *gestalt* of education or at least of industrial arts.

Finally, it seems worthwhile to explore the possibility of reviewing under categories developed out of theoretical constructs or problem areas in the field to which the research addresses itself. Possibly this can be an organizing device. Unfortunately, reviewers in our field may encounter difficulty in identifying theoretical framework in which much of our research is being conducted, because our research reports are often unclear regarding this matter.

GAPS--WEAKNESSES OBSERVED

Industrial arts is a young discipline. We have good researchers in the discipline, but unfortunately, not enough of them. Some areas of research must be improved and some gaps must be filled.

The pattern of research in our field is most haphazard. One is reminded of Bauernfeind's article in the October 1968 *Phi Delta Kappan*, in which the need for replication in educational research is reviewed. There is no satisfactory program for needed replication of industrial arts research. One can go a step further

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[1] Robert H. Bauernfeind, "The Need for Replication in Educational Research," *Phi Delta Kappan*, Vol. L, No. 2 (October 1968), p. 126-128.

regarding replication. It seems that what we very badly need to communicate and participate with basic researchers in education. Possibly, the new United States Office of Education programs to encourage basic research in education will lead to theory testing and problem identification as they apply to major curriculum areas. While this may encourage one type of replication, there would be further need to have a system of replication, when required, within each curriculum area in order to eliminate the various types of research errors to which Bauernfeind refers.

Experimental research has captured our imagination in education. Unfortunately, many practitioners, while aware of the tools and techniques of experimental research are often awed or frightened by it. Practitioners and graduate students and their advisors, who are so awed and frightened, may come to the erroneous conclusion that other seemingly less esoteric methods of inquiry, *e.g.*, descriptive, normative survey (or status, associational), are inappropriate to their needs. The grave error in this decision is that these other methods are equally demanding, challenge creative minds, and call upon equally high levels of inferential, though not always statistical ability.

Anyone of a number of methods of inquiry or research fields can be selected to exemplify the preceding problem. Our attitude toward historical research and historiography is typical. Historical research involves a refined and complex methodology and the writing of historical research reports requires ability in analysis and synthesis of an extremely high order. Unfortunately, at least in the historical research in industrial arts which this reporter has read, knowledge of a method of inquiry or report writing are rarely demonstrated.

If this is typical of other methods of inquiry--and in varying degrees, it is--then, to the extent that methods of inquiry are interdependent, each will be weakened.

Consequently, that part of our philosophical structure built on data empirically derived within industrial arts may be dangerously weak. Similarly, "problem areas" identified in poorly conceived associational and status studies may not be "problem areas" at all and may dangerously mislead the experimental researcher seeking to apply his methods of inquiry to problems so identified.

The preceding has been couched in generalities. Nevertheless, the assignment as best it could be interpreted has been fulfilled. Hopefully, this material will stimulate meaningful discussions and recommendations at this conference on research in industrial arts.

APPENDIX F

DIGESTS OF SELECTED DOCTORAL RESEARCH IN INDUSTRIAL ARTS EDUCATION

(1955-1968)

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Participants in the Research Conference were invited to submit abstracts of dissertations which dealt with industrial arts education and were completed at their institutions since 1955. All the abstracts received have been reviewed. *Dissertation Abstracts* copy was used for identified studies that were not accompanied by abstracts.

In preparing the notes included in this publication, the reviewer has been guided by these principles:

- Only the abstract submitted or obtained from *Dissertation Abstracts* has been consulted for factual content. In some instances, this restriction has seemed to be unduly restrictive. However, it seemed inappropriate to obtain additional data on only a few studies, when it was physically impossible to read the 336 studies in the time available for the preparation of this review.
- No specific content coverage was imposed upon the digests. As a result in some instances the focus has been upon methodology; in others, purpose statements have received primary emphasis; in still other situations, conclusions, findings, or recommendations have seemed to be most appropriate. An attempt has been made to highlight those aspects of each study which were considered to have the broadest probable interest to readers of this review.
- When it was possible, digests were limited to a maximum of approximately 100 words.

Sincere appreciation is expressed to the co-directors of the conference, W. R. Miller and Alan R. Suess, for offering the opportunity to prepare this review, and to the many individuals who made abstracts available on very short notice.

ARIZONA STATE UNIVERSITY

Aguirre, Edward. An Experimental Study of Two Methods of Teaching Engine Lathe Principles and Procedures. 1966.
Engine lathe principles and operating procedures were taught to 58 beginning metalworking students at two colleges using two methods: 1) programmed instruction-demonstration; and 2) illustrated lecture-demonstration. The two methods of instruction were equally effective in terms of immediate learning and retention as assessed by an achievement test; and in proficiency of engine lathe operation, as measured by a performance test.

Jared, Alva Harden. The Effects of an Extreme Climatic Condition on the Relative Efficiencies of Heating and Air Conditioning a Frame Structure and a Masonry Structure. 1968.
Two buildings, one of insulated scoria block on a concrete slab, and the other of insulated wood-frame over a crawl space, were erected with equal cubic volume, glass surface, doors, and environmental orientation. Recording potentiometers provided a record of data from thermocouples in the structures, which were heated and cooled by means of independent heat pumps. In terms of operational efficiency of air conditioning and heating, the insulated frame structure was more efficient than the masonry structure. Heat transfer was greater through the masonry floor than the frame floor; and greater through wood window components than through aluminum components.

Little, Richard Lee. A Descriptive Study of Selected Technical Manpower Needs of the Foundry Industry, with Implications for Higher Education. 1968.
Engineering, technical, and management personnel from commercial foundries rated the importance of 92 course and concept items in five instructional content areas. The extent of agreement was significant for 36 of the items; there was substantial agreement on others. The subjects were rated in this order of decreasing importance: foundry, related foundry, mathematics, science, and business. Manpower needs were expected to increase, and identifiable sources of difficulty in recruiting were identified.

Noll, Robert Francis. Mathematics and Science Requirements for Drafting Technicians. 1967.
Drafting technicians, drafting supervisors, employment supervisors, and college instructors responded to a questionnaire survey dealing with mathematics and science requirements for drafting technicians. The applications of mathematics skills to problems encountered by drafting technicians occurred approximately twice as often as the application of science skills. Mathematics and science requirements in community college curricula were found to be above the levels required for successful performance as a drafting technician. Approximately one in eight required mathematics skills and one in 12 science skills were considered to be beyond the basic level.

Worthington, Kent L. An Experimental Study to Determine the Differential Concentrations of Particulate in the Air of Vented School Shops and Unvented School Shops. 1967.
Impinger sampling techniques and light stage counting techniques were used to assess particulate concentration levels in school shops. Significant differences were obtained between the particulate concentrations in industrial arts laboratories where hooding and venting systems were installed and in laboratories without such systems. In addition, significant differences in particulate concentration were obtained between laboratories among those which had individual hooding, venting or exhaust equipment. Similarly, significant differences were identified between laboratories among those with no exhaust equipment.

COLORADO STATE COLLEGE

Anderson, Robert Granville. The Contribution of Industrial Arts Instruction to Occupational Knowledge. 1967.
An occupational information test was developed and administered to the senior boys in 25 high schools. Boys who had completed graphic arts courses possessed more knowledge of occupational opportunities in that field than did other students, and students who had completed more than two semesters of graphic arts were superior to those who had one or two semesters. Similar findings were obtained in the metals area. A combination of metal and graphic arts courses produced higher scores on the occupational information test for each of the areas than those attained by students completing courses in only one area.

Backus, Kerby Dewel. A Study of Perceived Objectives of Industrial Arts Among Superintendents, Industrial Arts Coordinators, and Industrial Arts Teachers of Six Public School Districts of Texas. 1968.
Teachers, industrial arts coordinators, and superintendents rated the importance of 54 statements of student behavior on a Q-sort instrument. Within the districts, teachers and coordinators tended to agree in their rankings. Between districts teachers agreed, but there was lower agreement among coordinators. Superintendents did not agree with each other nor with coordinators or teachers. A single order of importance of objectives was developed: 1) habits of orderly performance; 2) shop skills and knowledge; 3) drawing and design; 4) appreciation and use; 5) health and safety; 6) interest in achievement; 7) cooperative attitudes; 8) self-realization and initiative; and 9) interest in industry.

Bagley, Ronald E. A Study to Determine the Contributions of Industrial Arts to the Leisure Time Activities of the Graduates of Northeast Missouri State Teachers College. 1965.
Graduates during the periods 1931-1939 and 1962-1964 were surveyed for information on their leisure-time activities. Industrial arts graduates indicated home repair, woodworking, photography, and electronics most frequently; other graduates listed walking, gardening, and reading. Most graduates thought

some portion of some college courses should be devoted to instruction for leisure-time activities. They were spending an average of nearly 10 hours per week on such activities, usually in the home.

Bergman, Kenneth H. Comparisons of Three Teaching Methods of Introductory College Electricity. 1963.
A teaching machine, a programmed textbook, and a regular textbook were used in teaching a beginning college electricity course. Subjects were given a pretest, a midterm, and a final test. All three methods were effective; the adjusted means of the three groups at the end of the experiment favored the group which had completed the programmed textbook.

Bonde, Robert Gibson. An Evaluation of Selected Elementary School Industrial Arts Hand Tools--Grade I. 1964.
Experimental evaluations were conducted with 60 first grade children of 19 sizes of tools in these categories: hammers, panel saws, coping saws, bit braces, hand drills, planes, and sawhorse workbenches. Trends identified during the study provided the basis for a basic list of recommended tools and appropriate sizes.

Box, Marshall Ray, Sr. Development and Standardization of an Achievement Test in General Woodworking for Grades Nine Through Twelve in the State of Texas. 1967.
The state curriculum guide and state-adopted textbooks provided the basis for content selection, and 80 teachers served on a content validation jury. After pilot testing, the 70-item test was administered to 2059 students in grades 9-12. Reliabilities within each grade level ranged from .86 to .89. Percentile ranks were computed for each grade classification to establish norms.

Brotherton, William A. Engineering Technology Education in Memphis, Tennessee: A Study of Needs. 1964.
A personal interview survey of engineers in Memphis industries identified an immediate and projected need for engineering technicians. An appropriate educational program was considered to be compatible with the programs of two- and four-year institutions of higher education.

Coleman, Wayne Dudley. Physical Science Understandings Important to the Education of Industrial Arts Teachers. 1966.
Physical science requirements were determined from a questionnaire sent to heads of departments of industrial arts teacher education. Secondary school industrial arts teachers and college industrial arts teacher educators were surveyed to obtain their opinions on the adequacy of preparation in physical science, their evaluations of principles, and their own undergraduate preparation. There was agreement about the importance of physical science principles, with emphasis on physics, and nearly half the teachers considered their own preparation inadequate. At least 12 semester hours of physical science were recommended, with more physics than chemistry.

Collins, Herman George. The Status and Trends of Industrial Arts Education in the State of Colorado. 1966.
All industrial arts teachers in Colorado were surveyed during the 1965-66 school year. The teachers were reported to be well prepared for their positions, staying in industrial arts, planning graduate work, and well acquainted with industry. As a subject area, industrial arts was found to be a growing field in the junior and senior high schools, supported by administrators, and serving average students. The acquisition of skills was considered to be the main purpose of industrial arts. The most prevalent approach to teaching was in a general shop, either limited or comprehensive.

Crist, LeRoy. Personality Variables of Industrial Arts Majors. 1961.
The *Edwards Personal Preference Schedule* was administered to college industrial arts majors. The *Schedule* differentiated between the industrial arts majors and the normative group of college men. The *Schedule* differentiated between the most successful and the least successful industrial arts majors.

Davis, Jim Lee. Power As Applied to Industrial Arts Teacher Preparation at the College Level. 1966.
Department heads listed in the *Industrial Teacher Education Directory* were asked to rate 171 items of information on power generation and transmission in terms of their importance in an industrial arts program. The majority of the respondents rated all items as important, and all agreed that power should be a part of the industrial arts program. The slowness of the movement away from auto mechanics toward the application of power in industry was attributed to the lack of adequate instructional materials. Coordinated use of several sources of specialized materials was recommended.

Doutt, Richard F. An Evaluation of Selected Elementary School Industrial Arts Hand Tools--Grades II, III, and IV. 1965.
Recommended equipment lists for grades two, three, and four were compiled from responses of members of the American Council for Elementary School Industrial Arts. A validation study was conducted, with a stratified sample of 180 students from the three grades performing tool operations with hammers, hand drills, and coping saws.

Dyke, Eugene L. An Investigation of Certain Factors for Predicting Success in College Engineering Drawing. 1962.
The relationships between success in engineering drawing at the college level and *American Council Education* test scores, *PEAT* test scores, and variables related to high school mechanical drawing were subjected to correlational analysis. Both the *PEAT* and the *ACE* test scores showed a positive relationship to engineering drawing grades. This relationship was higher for students without high school mechanical drawing than for those with mechanical drawing.

Farahbakhshian, Ebrahim. Analytical Study of Cooperative Education in the United States and Development of a Proposed Plan for Iran. 1967.

State directors of vocational education were contacted for information about their cooperative vocational programs. A proposed program was developed for Iran, and specific recommendations for its implementation were outlined.

Frisby, Russel Charles. A Survey of Selected Metropolitan Milwaukee Industries to Determine Vocational Qualifications Desired in High School Graduates. 1968.
Interview questionnaires were administered in 48 industries in the Milwaukee area. The results indicated a desire for closer relationships between industry and the vocationally-oriented educational programs. The consensus emphasized broad, basic, exploratory courses as closely related to industrial jobs as possible. Respondents thought consideration should be given to the development of the 13th and 14th years of terminal industrial education.

Gadbois, Robert Leon. A Study of the Relative Holding Power of the Academic, the Industrial Arts, and the Vocational Curricula of the High Schools of Colorado Springs, Colorado; Compared on the Basis of the Magnitude of Student Scores on Probability Towards Dropping Out. 1967.
A multiple regression equation developed by the Colorado Department of Education was used to establish dropout probability scores for tenth grade students in academic, industrial arts, and vocational curricula. Since the vocational group was smallest, with 50 students, matched samples were selected from the other groups to obtain a total sample of 150. Of these, 11 in the academic curriculum dropped out, while seven dropped out of industrial arts, and six dropped out of the vocational curriculum before graduation.

Griffin, Raymond V. An Analysis of Selected Science Concepts to Determine Industrial Arts Related Experiences Suitable for an Integrated Elementary Industrial Arts Program at the Intermediate Grade Levels. 1965.
A survey of college teachers, secondary industrial arts teachers, and elementary industrial arts teachers or coordinators disclosed agreement among the groups that industrial arts could make a contribution to the understanding of the science concepts identified from an analysis of elementary science textbooks. The groups were also in agreement concerning which experiences would be valuable, and which would be appropriate for each of the grades four, five and six.

Grumbling, Henry Maner. Dial Access Information Retrieval Systems in Higher Education and Implications for Establishing a System at Colorado State College. 1968.
The study of 128 colleges and universities indicated that 87 had operating dial access systems. Of these, 76 were for audio reception only; the remaining 11 were audiovisual systems. The systems were being used for individualizing instruction, providing flexible access to materials, and review or reinforcement of learning in courses in biological sciences and in the humanities. Many additional institutions

could make effective application of an audiovisual dial access information retrieval system.

Hansen, Max E. Industrial Technology and the Engineering Withdrawal. 1964.
Engineering withdrawals, industrial representatives, and engineering deans were interviewed to identify the nature and scope of the need for industrial technology programs. The need for such curricula was found to be crucial. A large percentage of engineering withdrawals indicated an interest in them and industrial representatives indicated interest in and concern for developing the curricula.

Hansen, Russell F. An Evaluation of Selected Elementary School Industrial Arts Hand Tools--Grades V and VI. 1964.
Skill tests were made with boys and girls from fifth and sixth grade levels, using hammers, saws, planes, drills, braces, and sawhorse workbenches. Time plus inaccuracy scores were calculated for each hand tool performance. A list of recommended tools for fifth and sixth grade students was developed.

Hawse, John Edward. An Analysis of Industrial Arts Objectives as Determined by Opinions of Selected Population Groups. 1964.
An opionnaire of 54 statements covering the nine American Vocational Association objectives was sent to industrial arts teacher educators, industrial arts teachers, high school administrators, industrial employment officers, and parents. All five groups considered these objectives very important: self-realization; attitudes; safety; achievement; and orderly performance. Teacher educators ranked an interest in industry higher than did the other four groups. Similarly, industrial arts teachers gave highest rankings to drawing and design and to shop skills and knowledge; the other groups ranked these objectives lower.

Hickman, Keith Frederick. A Comparison of Methods with Film, Lecture and Printed Instructional Materials for Teaching Graphic Science. 1967.
Thirty lessons in basic descriptive geometry were presented by lecture, printed information sheets, and 8mm single concept sound films. Results were not conclusive, but the films produced test performance significantly better than the other two methods in one of the comparisons, and information sheets were more effective in another comparison. In terms of net learning and retention, the three methods were equally effective over the two-semester study. The lectures required more time than the other two methods, though the lectures were the least expensive of the methods to produce.

Hinckley, Edwin Carlyle. An Experimental Study: Relative Effectiveness of Four Techniques of Teaching Wood Identification. 1963.
College students were taught a unit on wood identification by four methods: 1) lecture, wood samples, and chart

worksheets (150 minutes); 2) completed charts, samples, colored slides, and lecture (40 minutes); 3) automatic teaching device used outside of class time, with classroom explanation of the machine operation (10 minutes) and a written outline; and 4) wood samples, blank identification sheets for outside study, with procedural explanations (10 minutes) and a written outline. The methods were equally effective in promoting learning; the most traditional method, (1), was least efficient in the use of class time.

Hoover, Roger Lee. A Comparison of Metalworking Processes Practiced by Contemporary Industry with Those Taught in Industrial Arts Teacher Education. 1967.
Metalworking processes were rated by 200 metalworking industries, and 195 industrial arts teacher preparation institutions were surveyed for their recognition of the processes included as instructional units. On the basis of the information obtained, it was concluded that the instructional programs were not reflecting industrial metalworking innovation adequately. Many of the more recent industrial processes were taught, frequently by lecture only, in a limited number of institutions.

Jackson, Peter A. An Investigation of Attitudes of College Industrial Arts Students Toward Industrial Arts Club Values. 1965.
The researcher developed an attitude inventory which was administered to seniors in industrial arts teacher education programs. The sample was dichotomized on the basis of membership or non-membership in college industrial arts clubs. No significant differences were identified between the attitudes of members and non-members about the values of college industrial arts clubs.

Jacobsen, James Huffman. A Study of the Contribution of Industrial Arts Instruction to Consumer Knowledge. 1964.
The behavioral outcomes of the American Vocational Association consumer knowledge objective provided the bases for the questions on the instrument developed by the researcher and administered to 764 high school senior boys in 20 high schools. Students who had industrial arts woodworking experiences scored higher on the test than did students without such experience; most of the differences were attributable to items relating to the wise purchase and use of wood and related materials and products. There were no differences in test performance between those students who had unit shop and those who had general shop woodworking instruction.

Kachel, Harold Stanley. An Identification of Philosophical Beliefs of Professional Leaders and Industrial Arts Teachers. 1967.
A list of 130 statements of beliefs about industrial arts method, course content, evaluation, curriculum, objectives, and philosophy were submitted to three groups: 1) nationally prominent industrial educators; 2) teacher educators within the state; and 3) industrial arts teachers within the state. The prominent persons tended to disagree or to agree

with the statements much more strongly than the two groups from within the state studied. The three groups were in general agreement on statements dealing with objectives, methods, and evaluation. Confused patterns of response were apparent in areas of course content and curriculum.

Kemp, William Harry. An Analysis of Basic Concepts of Graphic Arts. 1966.
Rating scales and card sorts were administered to 104 graphic arts teacher educators and 109 high school graphic arts teachers. Twelve basic concepts of graphic arts were ranked by the respondents, and priorities were assigned to informational and operational activities. The two groups did not differ in their ranking of concepts, with design considered most important. Both groups stressed operational experiences more than informational experiences, minimized memorization learning, and emphasized application with understanding.

Low, Fred F. A Study of Industrial Arts Skills and Teaching Techniques as Appraised by Elementary Teachers, Compared to Those Taught by California Colleges. 1963.
A sample of 217 elementary teachers responded to a questionnaire by rating industrial arts skills and teaching techniques. Most of the items were considered to be of more than moderate value in their classes. College instructors of industrial arts classes for elementary teachers responded to a similar questionnaire, and assigned higher values to parallel items.

McRobbie, J. M. Identification of Strengths and Weaknesses of Occupational Tasks Performed by California Supervisors of Industrial Arts, as Determined by Analysis of Critical Incidents. 1963.
A critical incident approach was used to evaluate the performance of 28 industrial arts supervisors. Skill in human relations was identified as the most critical factor in their successful performance. Supervisors were considered to be making relatively little effort in research, evaluation, and planning. A sample of industrial arts teachers who did not have an industrial arts supervisor indicated that the lack of a supervisor was a serious handicap in the performance of their professional tasks.

Meline, Charles Wendell. A Critical Analysis of the Educational Objective to Develop Interest in Industry and Its Relationship to the Graphic Arts. 1965.
A list of 74 concept statements in seven concept areas was used in the instrument designed to cover the objective, interest in industry. The instrument was administered to members of Printing House Craftsmen Clubs and Printing Industry of America. The two groups differed in their ranking of the seven concept areas, but their rankings of the 74 concept statements were significantly related.

Messman, Warren B. Interest Patterns of Freshmen Industrial Arts Majors in Comparison with Personality Traits. 1963.

The *Edwards Personal Preference Schedule* and the *Minnesota Vocational Interest Inventory* were administered to male freshmen industrial arts majors at two institutions. The two groups were differentiated by the *Edwards Personal Preference Schedule*, but not by the *MVII* scores. The personality variables identified by the *Edwards* and the vocational interests identified by the *MVII* were related in the sample used in this study.

Monroe, H. B. Personality Variables of Industrial Arts Teachers. 1960.
The industrial arts teachers in a large city school system were ranked according to their effectiveness by their supervisor. The *Edwards Personal Preference Schedule* and the *Strong Vocational Interest Blank* were administered. The *Edwards Personal Preference Schedule* differentiated between the most successful and the least successful teachers; the industrial arts teacher scale of the *Strong Vocational Interest Blank for Men* did not differentiate between the two groups.

Morgan, J. B. Personality Variables of Industrial Arts Teachers. 1961.
The *Edwards Personal Preference Schedule* was administered to industrial arts teachers, who were also ranked by their supervisor. The *Schedule* differentiated between the most successful and the least successful teachers. It also differentiated between the elementary school industrial arts teacher and the senior high school industrial arts teacher.

Morgan, Leo Donald, Sr. Development and Standardization of a Test in Basic Electronics for the Eighth Grade in the State of Minnesota. 1966.
Content coverage for an achievement test for the required eighth grade course in electronics was established from the state curriculum bulletin and validated by a jury of electronics instructors. A pilot study was used to obtain preliminary data on item difficulty preparatory to the development of the 45 five-alternative, multiple-choice items for the final instrument. Administration of the instrument to a statewide sample of 1092 students who had completed the course yielded a Kuder-Richardson Formula 20 reliability coefficient of .861.

Nelson, Rex A. Personality Variables of College Students Who Signify Industrial Arts as a Major Field of Educational Preparation. 1963.
College industrial arts majors were compared with other students in earlier studies on the basis of data from the *Edwards Personal Preference Schedule*. The sample of industrial arts majors could be differentiated from the normative sample of college men. While the *Edwards Personal Preference Schedule* offered assistance in guiding a freshman toward industrial arts, it did not help in predicting academic achievement.

Pardini, Louis J. The Content of Industrial Arts Metal Classes as Compared to Modern Industrial Practices. 1967.
Two questionnaires were used: one to metal processing industries; the other to industrial arts teachers. Both included lists of metal shaping, forming, and joining processes. On the basis of the returns, it was held that the teachers of the state were presenting only a limited number of processes on basic metalworking machines. A number of schools offered no instruction in metal processing, and few included instruction on the newer metalworking processes. The objective of interpreting industry to youth was not being fulfilled in the secondary schools surveyed.

Piersall, Arnold Cecil. An Experiment in the Use of Three Different Methods to Teach a Technical Information Unit in Industrial Arts Woodworking. 1964.
College freshmen were taught an information unit by three methods: 1) a lecture-chalkboard presentation; 2) information sheets; and 3) lecture supplemented by closed circuit TV. The three methods were equally effective in overall learning and retention. The instruction booklets consumed only five minutes of classroom time, while the other two methods required 100 minutes each.

Prust, Zenas A. Changes in Student Attitudes Toward Safety Education in the Graphic Arts Laboratory. 1964.
A unit on safety in film developing was presented by three methods: 1) lecture and discussion; 2) lecture, film, and discussion; and 3) lecture, film, and discussion. An additional requirement was that rubber gloves be worn at all times when chemicals were handled or film was being developed. Positive attitude change was not significantly achieved by any of the three methods, as measured by a scale of attitude development for chemical safety.

Ricker, Phillip E. An Experimental Comparison of Four Methods of Presenting Basic Properties of Magnetism. 1965.
A unit on magnetic properties was presented to college physical science students by four methods: 1) lecture and teacher demonstrations; 2) lecture and student experiment; 3) lecture and programmed learning; and 4) lecture only. Analysis of the gain scores on tests of immediate learning and retention indicated that the four methods were equally effective. The lecture only approach required the least amount of time of the instructor and the students. Suggestions were made for planning experimental research on methodology.

Rinck, Joe Arnold. A Comparative Study in Aviation Airframe and Powerplant Mechanics--Needs of the Mechanics as They Relate to Content in the Technical Schools and Suggestions for Course Content in the Technical and Secondary Schools. 1968.
A questionnaire including 420 topics of information in 35 courses was sent to directors of certified airframe and powerplant mechanic schools and to directors of certified airframe and powerplant repair stations. The responses indicated no great differences between the needs of the

repair stations and the courses in the schools. Most of the courses, it was felt, could be offered at the high school level.

Ryan, Robert D. A Study of Student Performance in First Year Technical Drawing at St. Cloud State College as Related to Certain High School Courses and *American College Testing* Scores. 1964.
Data were gathered on 226 students who had completed a college course in technical drawing. Performance in technical drawing was not correlated with the amount of high school drawing or with the completion of advanced mathematics in high school. Students who had both 1) two or more years of high school drawing and 2) advanced mathematics did better in technical drawing than students without such backgrounds. *ACT* scores exhibited low correlations with performance in technical drawing.

Sanders, Leroy John. Aerospace Education for Teachers Based on Recommendations of Selected Aviation and Space Industries. 1967.
Open-end opinionnaires were sent to member companies of the Aerospace Industries Association of America asking for evaluations of instructional units, of types of industry-education experiences, and information about instructional materials. College courses in aerospace education for elementary teachers and in aviation education and space education for secondary teachers were suggested. Tours of aerospace industries, school visits by industrial representatives, use of the periodical literature, and memberships in the aerospace education associations were recommended.

Talkington, Joe Ed. An Analysis of Industrial Arts Objectives as Determined by Q-Technique. 1962.
A Q-sort instrument using 54 behavioral statements to describe nine industrial arts objectives was administered to 35 prominent persons in industrial arts and to a sample of industrial arts teachers. The two groups assigned first priority to the objective, habits of orderly performance; second priority was assigned to shop skills and knowledge. Eighth priority was assigned to self-realization and initiative. There was a lack of agreement between the two groups on the appropriate ranking for the remaining six objectives. The disparity between rankings of the state and national samples was considered to indicate the lack of unity of direction.

Thomas, Charles Lewellyn. The Relationship of Competence of Industrial Arts Student Teachers to Dogmatism as Revealed by the *Rokeach Dogmatism Scale*. 1964.
One hundred and sixty-eight industrial arts student teachers from seven institutions were administered the *Rokeach Dogmatism Scale* and were rated for competence by their supervisors. No significant relationship was found to exist between dogmatic tendencies and competencies in the overall analysis.

Torres, Leonard. A Study of the Relationship Between Selected Variables and the Achievement of Industrial Arts Students at Long Beach State College.
Prediction formulas were developed to predict grade point averages during the first semester and during the third semester in college. Junior college grades and scores on the *Owens-Bennett Test of Mechanical Comprehension, Form CC*, the *Minnesota Paper Form Board Test, Series MA*, and the *Cooperative English Ability Test, Form AA*, were used in developing the prediction formulas.

Trautwein, Calvin Leroy. An Experimental Comparison of Three Methods Used to Identify Industrial Materials. 1962.
College students were tested for accurate identification of industrial materials with which they were familiar under three conditions: 1) numbered samples which could be observed through the five senses; 2) samples under museum conditions, permitting observation by sight alone; and 3) photographic representations of materials by means of three-dimensional color transparencies. Method (1) was most effective, followed by methods (2) and (3), respectively.

Tucker, Casey A. Creativity and Its Relationship to Success in College as Measured by the Grade Point Average. 1965.
A random sample of students from five teacher education curriculums was tested, using the *A.C. Test of Creative Ability* and *Form VII Minnesota Test of Creative Thinking*. Cumulative grade point indexes were obtained for all subjects. No significant relationship between grade point index and creativity test scores was detected.

Vacek, William L. Personality Variables of Male College Freshmen with Emphasis on Industrial Arts. 1962.
Male college freshmen in eight areas of education (business, humanities, industrial arts, mathematics, music, science, social studies, and health and physical education) completed the *Edwards Personal Preference Schedule*. On the basis of the *Schedule*, industrial arts majors could be differentiated from majors in business, humanities, music, science, and social studies; industrial arts majors were not differentiated from majors in health and physical education or in mathematics.

Woody, Earl Thelmer, Jr. Analysis of the Perceived Objectives Among Industrial Arts Teachers. 1963.
A statewide sample of 336 industrial arts teachers and 27 industrial arts teacher educators, as well as a national sample of 30 prominent persons, responded to a Q-sort instrument consisting of 54 statements over nine objectives of industrial arts. The objective, habits of orderly performance, received first priority from all three groups. Self-realization and initiative was the objective ranked eighth by all three groups. Two of the groups agreed upon a ranking for most of the remaining objectives; however, the groups agreeing varied with the objective.

UNIVERSITY OF ILLINOIS

Arnold, Joseph Paul. Technical Education Curricular Recommendations by Management Representatives of Manufacturing Establishments in Illinois. 1965.
Technicians and managers at three levels of authority ranked each of 99 curriculum components in terms of relatedness to the job of the technician. Responses of technicians did not differ significantly from the managers' responses on the criterion of generality, which was defined as the number of items considered to be related, and the value assigned to each item on a continuum from general to specific.

Bailey, Larry J. An Investigation of the Vocational Behavior of Selected Women Vocational Education Students. 1968.
A sample of 485 practical nursing students was studied to determine the applicability of Super's vocational development theory. In general, the exploration stage outlined by Super was experienced by the subjects. Indications were that women's vocational behavior warranted additional theoretical considerations in contrast to the vocational behavior exhibited by men.

Blomgren, Roger Dean. An Experimental Study to Determine the Relative Growth of a Selected Group of Industrial Arts Education Majors Toward Gaining an Understanding of American Industry. 1962.
A criterion test covering industrial history, labor, management, and production technology was developed from an outline of content in publications recommended by experts in the major areas of industrial study. The instrument was used to assess the relative understanding of American industry possessed by college freshmen and seniors majoring in industrial arts education and in social science.

Buffer, James John, Jr. A Study of Certain Effects of Test Interpretation in Counseling Upon Achievement and Self-Perceptions. 1966.
Matched groups were subjected to a series of two counseling sessions using two methods of interpreting science achievement test scores: 1) positively oriented counseling; or 2) neutrally oriented counseling. Participation in test interpretation counseling improved subsequent science achievement test preformance, but it did not change interest in science or perception of general learning ability, when the counseled groups were compared with a matched, untreated control group.

Face, Wesley Lloyd. Multi-Track Sequential Analysis in Educational Evaluation. 1963.
A system of sequential analysis was developed to utilize successive samples of student performance on multiple-choice tests. A self-scoring device was used, and each student recorded his performance on a cumulative graphic display. Observations were stopped when the total performance attained one of the areas of decision in the multi-track system.

Grote, Charles Nelson. A Comparison of the Relative Effectiveness of Direct-Detailed and Directed Discovery Methods of Teaching

Selected Principles of Mechanics in the Area of Physics. 1960.
Eighth grade students were taught selected principles of mechanics during two 40-minute sessions, utilizing tape recorded instruction in two methods: direct-detailed, and directed discovery. Multiple-choice tests of initial learning, retention, and transfer provided criterion data. Analysis of variance statistical treatments were used to test hypotheses related to differences between methods, between sequences of methods, and differences in achievement by the three ability levels.

Herring, Tod Hamilton. An Exploratory Investigation of Knowledge of Electricity and Electronics Among Eighth and Ninth Grade Boys. 1962.
A multiple choice test was developed from a content analysis of textbooks for junior high school electricity-electronics. After a pilot study, the refined test was administered to 433 subjects in eighth and ninth grades to obtain normative data and to investigate relationships between test performance and data from tests of mental ability. Several leisure-time activities were identified as being associated with high scores on the test. Taking industrial arts electricity did not result in higher test scores; this was attributed to the high level of understanding which resulted from other courses and general cultural influences.

Householder, Daniel Lee. Effects of Programmed Instruction Upon Initial Learning, Retention and Subsequent learning from a Textbook. 1963.
A textbook, a linear program, and a branching program were used to teach a unit on screw threads to junior high school students. The three treatments were equally effective in terms of initial learning and retention, but the textbook required less time than the programs. None of the treatments had an identifiable effect upon subsequent learning of an independent task from a textbook.

Hull, Thomas Franklin. An Experimental Study of the Effect of Practice on the Performance of Task Analyzed Operations. 1964.
An initial training period was used with all subjects for each of two task analyzed operations: 1) an intellectual task, solving Ohm's Law problems; and 2) a manipulative task, inserting pegs into a pegboard. One group received a repetition of the training; a second group practiced the operation; and the control group received no further instruction. The practice group was most effective in performing the manipulative task, and females were superior to males in performing the manipulative task. High intellectual ability subjects did better on the intellectual task than lower intellectual ability subjects.

Lockette, Rutherford Emanuel. The Effect of Level of Aspiration Upon the Learning of Skills. 1955.
Junior and senior high school students planed a block of wood to pre-set dimensions according to instructions which were varied to produce differences in level of aspiration.

Levels of aspiration, or goal-setting, were significant determinants in the learning of the skilled task. Realistic levels of aspiration produced greater efficiency in learning skills than did unrealistic levels of aspiration.

Luetkemeyer, Joseph Fredric, Jr. An Experimental Study Comparing the Relative Effect of Immediate and Delayed Measurement on Retention of Principles of Architectural Drafting. 1961. A tape recording presentation was used to teach facts, definitions, and concepts about architectural drafting to eighth grade students. The 10 experimental groups were subjected to differing patterns of administration of a criterion test of knowledge, translation, and interpretation. Time sequences for test administration were immediately, one hour later, 24 hours, one week, and eight weeks after instruction.

Moss, Jerome, Jr. An Experimental Study of the Relative Effectiveness of the Direct-Detailed and the Directed Discovery Methods of Teaching Letterpress Imposition. 1960. Letterpress imposition was taught by tape recorded instruction to senior high school students in vocational curricula. Two methods were compared: 1) direct-detailed, with continuous, positive presentation of all information to be acquired and understood; and 2) directed discovery, which provided direct, positive instruction for basic content, then relied upon structured questions and hints to facilitate student discovery of information and relationships. The two methods were equally effective in terms of learning, retention, and transfer as measured by the criterion tests.

Nelson, Lloyd Palm. Selected Factors Associated with High School Students' Original Interest and Subsequent Development of Interest in a Favorite Leisure-Time Activity. 1955. Questionnaires were used to identify high school students who had a favorite leisure-time pursuit. A sample of 49 students was interviewed, using a structured interview schedule of 54 questions. The data obtained in the study did not provide adequate evidence to identify specific contributing factors in initial hobby interest and in the subsequent development of the hobby.

Porter, Charles Baddeley. An Experimental Investigation of Selected Variables Related to Morse Code Learning. 1957. Matched pairs of subjects were obtained by testing individuals who had been trained to a criterion of error-free copy of the alphabet. An experimental treatment which tended to force the reorganization of motor and auditory letter habits into appropriate word habits was used with one group. Paired associates training was more effective in training individuals to receive coded groups material. There was evidence that the experimental method was more effective for training individuals to receive clear text Morse Code materials.

Ray, Willis Eugene. An Experimental Comparison of Direct and Detailed and Directed Discovery Methods of Teaching

Micrometer Principles and Skills. 1957.
Ninth grade boys were taught an informational and manipulative unit on the vernier micrometer by two methods: 1) traditional direct and detailed instruction; and 2) directed discovery, which provided opportunities for solving problems. The two treatments were equally effective when measured on tests of initial learning and retention at one week. However, the results of a retention test given six weeks after instruction, and a transfer test administered one week and six weeks after instruction favored the group which had learned via the directed discovery method.

Rowlett, John D. An Experimental Comparison of Direct-Detailed and Directed Discovery Methods of Teaching Orthographic Projection Principles and Skills. 1960.
Directed discovery and direct-detailed methods were used to present instruction on orthographic projection principles and skills to ninth grade boys and girls. Workbook problems were solved in accordance with instruction presented by tape recording. The two methods were equally effective in terms of initial learning. However, results of retention and transfer tests administered one week and six weeks after instruction favored the directed discovery method. No significant interaction was identified between teaching methods and ability levels

Shemick, John Magnusen. Evaluating Initiative and Self-Reliance in Industrial Arts Classes. 1960.
An observation rating scale was developed to obtain criterion scores. A self-administered forced-choice inventory was developed for evaluating the initiative and self-reliance possessed by high school industrial arts students. The forced-choice inventory was not successful in evaluating initiative and self-reliance in industrial arts classes in the validation study. The observation rating scale was moderately reliable.

Stadt, Ronald Wilmer. A Method of Selecting Content for Lending Intelligibility to Industry: A Critique and a Proposal. 1962.
Contemporary methods of content selection in industrial arts education were reviewed and found to be incompatible with the principles of content selection implied in the educational theory of Foster McMurray. Guidelines were proposed for the development of a method for selecting content which would lend intelligibility to industry in a manner which would be compatible with McMurray's theory.

Suess, Alan Roman. An Experimental Study Comparing the Effectiveness of Varying Degrees of Manipulation on the Directed Discovery Method of Presenting Principles of Orthographic Projection. 1962.
The experimental directed discovery treatment developed by Rowlett was replicated, with variations in the type and sequences of manipulation. Scale model blocks and workbook problems, some of which required the completion of views by the addition of lines, served as experimental modifications. No statistically significant differences in initial learning, retention, or transfer test performance were

identified which were related to the amount of manipulation during the learning treatment.

Sullivan, Frank Victor. An Experimental Study of the Effectiveness of Two Methods of Teaching Orthographic Projection in Terms of Retention and Transfer. 1964.
Eighth grade boys were introduced to orthographic projection by two methods: 1) traditional, with instruction in multiview orthographic projection followed by isometric drawing; and 2) experimental, with isometric projection correlated with two or three multiview projections. The experimental method was more effective in terms of initial learning and retention, and appeared to be more effective in terms of transfer to other drawing systems.

Tomlinson, Robert Morris. A Comparison of Four Methods of Presentation for Teaching Complex Technical Material. 1962.
Content dealing with the metallurgy of carbon steel was presented by four methods: 1) inductive; 2) deductive; 3) inductive-discovery-confirmation; and 4) inductive-discovery. Matched groups of 36 subjects each received the experimental treatments. Five objective tests were administered. Questionnaires were used to assess student interests, attitudes, and reactions. Significant differences between treatments were not consistent in direction or degree across the achievement assessments, with initial learning, and retention and transfer at one week and at five weeks serving as criterion measures.

UNIVERSITY OF MARYLAND

Baron, Andrew William. The Effectiveness of Teaching a Psychomotor Task via a Teacher Prepared Video-tape Recording. 1968.
Seventh grade students were taught to compose and justify a line of type by hand by means of live demonstrations or video-tape recording. Written and performance data were obtained immediately after instruction and after a delay of one day. The video-tape and the conventional method were equally effective in teaching the psychomotor task, and in reaching the cognitive information to upper ability students. Students of lower ability were less effective with the video-tape presentation when criterion tests were administered after a delay of one day.

Burns, William E. An Experimental Study of the Attainment and Retention of Learnings in Industrial Arts Drawing when Classified According to Selected Educational Goals. 1965.
High school students of mechanical drawing were presented with facts and principles relating to mapping and the mapping industry by means of lecture, discussion, reading assignments, sketches, and training aids. The 90-item criterion test was developed with an equal number of items designed to measure knowledge, translation, and interpretation. The test was administered immediately after

instruction, 15 days later, and 13 weeks later. Scores on the translation portion of the test were better than on the other two sections. Achievement in knowledge and interpretation were approximately equal. Ability was an important determinant of retention.

Buxton, Robert E. The Identification of Physical Science Principles for Industrial Arts Metalworking Content.
Principles of chemistry and physics were identified. Consultants evaluated the importance of the principles to an understanding of 10 industrial metalworking processes. Principles involved in all 10 processes were those related to heat, the properties of energy and matter, the chemical nature of matter, and the structure of matter.

Heyel, Clarence L. An Experimental Comparison of Self-Paced and Group-Paced Auto-Instructional Methods of Teaching a Manipulative Skill and Related Cognitive Knowledge in Industrial Arts. 1967.
Eighth grade students were taught to prepare and lock up a single type form by means of one of two methods: 1) individual self-paced programmed booklets; or 2) 35mm slides paced by the last subject in the group to respond to the projected frame. The two methods were equally effective in terms of performance on a written test of immediate learning and retention. The self-paced method was more effective for lower ability subjects in terms of performance; the upper ability students did equally well with either method. Group-paced subjects required less time than the slowest individually-paced subjects.

Manchak, Paul J. An Experimental Comparison of Two Methods of Teaching a Perceptual Motor Task in Industrial Education. 1965.
Twelfth grade electronics students were taught a perceptual motor task by two methods, one of them programmed instruction. None of the methods tested produced statistically significant differences in performance. Achievement on a cognitive test was equivalent across methods for upper ability subjects, but not for lower ability subjects.

Massey, Hal. A Research Instrument for Measuring the Unique Contributions of Industrial Arts to the Goals of General Education. 1965.
An evaluation instrument using 60 multiple-choice items was developed to evaluate the contribution of industrial arts to general education on four objectives. In its final form, the instrument was administered to 1082 ninth grade industrial arts students and 313 ninth grade non-industrial arts students. Standard College Ability Test percentile ranks were also obtained for all subjects. Participating industrial arts students were significantly below non-industrial arts students in ability level; however, the two groups performed equally well on the achievement test. When comparisons were made by deciles on the SCAT, industrial arts students scored higher on the achievement test on four of the decile comparisons and there were no differences on five comparisons.

Meosky, Paul R. A Study of the Relationship of Personality to Teaching Success in Industrial Arts at the Secondary School Level. 1967.
Practicing industrial arts teachers who had graduated from one institution between 1962-65 completed *Cattell's Sixteen Personality Factor Questionnaire*. Each teacher's principal (and industrial arts supervisor, if he had one) completed a supervisory rating instrument. The supervisory ratings were used to identify most successful and least successful teachers. When the most successful and the least successful groups were compared on the basis of personality factors, none of the 16 factors successfully differentiated between groups. Supervisory ratings were skewed toward the top of the scale, and were related to college grade point average and teaching experience. Principal's and supervisor's ratings tended to be closely related.

Mooney, James J. An Investigation of Professional Growth of Students Majoring in an Industrial Arts Education Program Regarding Selective Professional Elements of Industrial Arts. 1967.
A 73-item inventory was developed to assess professional growth in terms of the elements of instruction in the professional sequence of courses at the cooperating institution. Significant growth in professional areas resulted from experiences in two of the four professional courses and from the student teaching experience. Industrial arts teachers with one year of experience had lower scores on the inventory than undergraduate students. Supervising teachers, industrial arts educators, and student teachers all had significantly different points of view, with the student teacher closer to the educator than to the supervisor.

Russell, James A., Jr. An Investigation into the Changes in Critical Thinking and Achievement in Electronics as the Result of Exposure of Subjects to Specific Techniques of Critical Thinking. 1967.
One group of electronics students was taught by conventional methods; another received the same instruction plus exercises in critical thinking. When pretest scores were used as a covariate, there was no difference between the group on the post-test administration of the *Watson-Glaser Critical Thinking Appraisal*. The two groups differed in mean scores on a test of achievement in electronics immediately after instruction and four weeks after instruction.

Schank, Kenneth L. Industrial Arts Supervision: A Synthesis of Selected Supervisory Principles and Practices. 1965.
Current literature in supervision was analyzed. The researcher developed a list of 11 functions of the supervisor and a checklist of skills needed by the supervisor of industrial arts. Supervisory activities common to all types of supervision were noted, and the unique demands of the industrial arts supervisor's role were explored.

Simich, Jack. Comparative Effectiveness of Self-Instructional Methods of Learning Including Programmed Instruction and the Correspondence-Course Technique in Classroom Situations. 1965.
Seventh grade industrial arts students were taught by the correspondence-course method or by means of programmed instruction. Gain scores on initial learning indicated that the correspondence-course technique resulted in significantly more knowledge than the programmed methods. When the retention test was administered three weeks later, however, the difference was not significant. Students at all three ability levels made substantial gains in knowledge in each of the treatments.

Wargo, William Dean. Attitude Orientations Toward Achievement of Students Preparing to be Industrial Arts Teachers. 1968.
Undergraduate industrial arts students were tested for attitude orientations toward achievement, using an instrument with six scales: effort-luck, future-present, man-nature, achievement through effort, control-acceptance, and effort-ability. Students who had high grade point averages were more oriented toward effort than luck when compared to their peers with lower grades. Students with industrial, business, or military experience before college were more oriented toward effort than luck, control than acceptance, and effort than ability than were those students without such experience. An equation for predicting grade point average was developed, utilizing class level, effort-luck scores, achievement through effort score, man-nature score, and professional memberships as contributing variables.

Yff, Joost. An Investigation of the Effects of Response Mode, Intelligence Level and Sex on Learning from Programmed Instruction. 1965.
Ninth grade students were administered a 100-minute treatment involving instruction on matter, energy, and work in linear program format and in booklet format. Response modes were: 1) explicit-overt, 2) explicit-covert, and 3) implicit. The experimental treatment effects did not attain statistical significance on the 45-item post-test, nor when the analysis of variance was computed on gain scores. Intelligence was significantly related to test performance.

Zane, Lawrence F. H. A Follow-Up Study of Public Secondary School Accreditation in Hawaii by the Western Association of Schools and Colleges. 1968.
A questionnaire was submitted to members of school staffs who had participated in the accreditation studies of their schools, and the actual situation as reported from the survey was compared with the recommendations of the visiting accreditation committees. Visiting committees recommended more action than had been taken in the schools at the time of the survey, and the followup activities were less than expected by the experts. Actions which were taken were in correspondence with visiting committee recommendations, and attitudes toward accreditation were improved after accreditation.

UNIVERSITY OF MINNESOTA

Anderson, Donald Norris. An Experimental Evaluation of Two Methods for Developing Creative Problem Solving Ability in an Industrial Arts Course. 1963.
Students in a college general education industrial arts class were given their usual instruction and either: 1) a series of written brochures and short ideation exercises, 2) a series of brainstorming sessions, or 3) no supplementary work. Pretest to posttest performance on a creativity test battery was improved most by the group receiving the combination of brochures and ideation exercises; there were no differences among the group means on the final test in the course.

Bjorkquist, David Carl. Discrimination Transfer from Scale Models and Pictorial Drawings in Learning Orthographic Projection. 1965.
Sixth grade boys were taught basic principles of orthographic projection by three methods: 1) pictorial (isometric) drawings of the problems, 2) full size models of the problems, and 3) no aids. A display device presented multiple-choice problems to individual learners in the learning situation, and feedback was provided until each learner attained a criterion level of seven correct answers to 10 problems. The group receiving pictorial drawings required the fewest trials, followed by the group receiving models, and the group receiving no aids, respectively. The group receiving pictorial drawings was also superior on a transfer task, where difference between other groups were not significant.

Bortz, Richard Frederick. A Study of the Effect of Physical Maturity and Intelligence on the Manipulative Performance of Junior High School Students. 1967.
Seventh, eighth, and ninth grade boys were measured for hand-eye coordination, manipulative ability, shoulder and elbow flexion and extension strength, and grip strength. Their performances with crosscut saws and nail hammers were assessed and then compared with the measures on the independent variables. It appeared that shoulder extension strength was the most significant variable contributing to hammering proficiency. In most cases, however, the relationships between the independent variables and performances were relatively small.

Clausen, John Norman. The Effect of an Entrance Requirement on Success in Selected Engineering Courses: An Experimental Evaluation for the School Year 1953-54 in the College of Engineering, Institute of Technology, University of Minnesota. 1955.
The study compared the influence of a course in solid geometry upon achievement in freshman courses in engineering drawing. A college course in solid geometry, completed prior to the first engineering drawing course, resulted in more effective learning than did a high school solid geometry course or no course in solid geometry. However,

the timing and/or completion of a solid geometry course did not influence achievement in the second course in engineering drawing.

Cornwell, Raymond Leland. Written Instructional Materials: An Experimental Comparison of Problem-Centered and Traditional Assignment Sheets. 1961.
Two types of instruction sheets were used in teaching an introductory college printing course: problem-centered, and traditional. The subjects receiving the problem-centered instruction sheets achieved higher levels of design and manipulative skill, and demonstrated higher levels of performance on tests of immediate learning and retention. Student preferences for the methods were not related to achievement.

Duenk, Lester Gerald. A Study of the Concurrent Validity of the *Minnesota Tests of Creative Thinking, Abbreviated Form VII*, for Eighth Grade Industrial Arts Students. 1966.
Relationships between scores on the *Minnesota Tests of Creative Thinking, Abbreviated Form VII*, scores on an industrial arts creative performance test developed by the investigator, and accumulated teacher ratings of observed student behaviors were studied. Creativity in the performance situation and measures of creativity were not significantly related, though certain personality traits were closely related to creativity. IQ measures predicted achievement better than any of the three independent creativity measures: figural, symbolic, and behavioral.

Flug, Eugene Ray Frank. An Experimental Evaluation of Selected Presentation Modes in the Self-Instruction of a Manipulative Industrial Arts Learning Task. 1967.
Seventh grade boys of high and low mental ability were taught to rivet aluminum by four self-instruction modes: 1) 35mm color slides, 2) slides with tape recorded audio, 3) 8mm color closed-loop film, and 4) film with audio. On the basis of the posttest results, the slides and the film were equally effective. The addition of audio instruction was helpful, especially for low ability students. Slides with no audio performed poorly with low ability students. The other modes were equally effective across ability levels. Few learners returned to the media after one viewing, even though urged to do so.

Furlong, John. Case Studies of Beginning Trade and Industrial Instructors in a Vocational Evening School. 1957.
Eight beginning teachers were studied intensively, beginning with one-hour tape-recorded interviews. Ninety randomly chosen observation periods of from one to one-and-one-half hours were made in their classes, with particular attention given to motivation, development of understanding, and student use of instruction in the classroom. The teachers were considered to be quite competent in their technical fields. They faced similar problems in planning their instructional programs and motivating their students.

Hahn, Marshall Sterling. The Influence of Creativity on the Effectiveness of Two Methods of Instruction. 1967.
High school students were administered the *Minnesota Tests of Creative Thinking, Abbreviated Form VII*, and were taught to use a micrometer by one of two methods: programmed instruction and directed discovery. On the basis of tests of initial learning, retention, and transfer, there were no significant differences between the two methods of teaching, or between groups identified as having high creative skills and those identified as having low creative ability. No interaction effects between creative ability and treatments attained significance.

Jackman, Duane Alan. Industrial Arts Competencies in Training Occupational Therapists: A Criterion Study of the Industrial Arts Competencies Required by Occupational Therapists with Implications for Curriculum Requirements and Teaching Procedures. 1961.
All 65 registered therapists in Minnesota were surveyed to determine the industrial arts competencies they employed in their work. Woodworking and crafts accounted for over 70 percent of their instruction, with most emphasis on hand woodworking, leather, stenciling, weaving, ceramics, art metal, linoleum block, and metal enameling. Numerous specific findings and recommendations were included as a guide to the development of educational programs for occupational therapists.

Johnson, Robert Irving. Design Competencies of Beginning Students in Woodworking. 1958.
Instructional materials stressing a problem approach to project planning were developed and used to supplement the usual instruction in introductory college woodworking classes for prospective elementary teachers. The students were willing to accept individual responsibility for developing original project plans, and did so early in the course. Subject matter mastery was not reduced by this approach, which produced consistently good quality projects.

Kavanaugh, William Arnold. Electricity in the Secondary School: A Study of the Objectives and Activities of Electrical Instruction in the Secondary School. 1955.
A preliminary inventory of objectives for electricity courses and items of electrical content was developed and submitted to secondary school electrical teachers, who evaluated the items in terms of their desirability. The final inventory, items agreed upon by at least 60 percent of the teachers, contained objectives and content items classified as desirable for junior high school, junior or senior high school, and senior high school courses.

Lease, Alfred Arnold. An Experimental Comparison of Linear Program and Standard Textbook in Learning Basic Electronics. 1964.
College freshmen spent 20 hours reading either a linear program or a textbook especially prepared to parallel the program in covering basic electronics information. The

textbook and the program were equally effective in terms of initial learning test performance, retention after six weeks, and the ability of students to apply information initially and after six weeks.

Lindbeck, John Robert. A Framework for Research in Industrial Arts. 1958.
A master list of nine generalizations was developed, based upon the claims made for industrial arts in the literature. From these, a system of appropriate hypotheses was developed, covering these areas: consumer education, appreciation, industrial knowledge, leisure activity, guidance, manipulative skills, desirable habits, learning, and creativity. Since none of these hypotheses were considered to be verified, it appeared that no theory of industrial arts existed, pending the verification of hypotheses.

Mudgett, Albert G. The Effects of Periodic Testing on Learning and Retention in Engineering Drawing. 1956.
Students enrolled in a beginning college-level course in engineering drawing were subjected to one of three testing frequencies: daily, weekly, or monthly. Effects of the testing program were apparent by the end of the ninth week, when students receiving daily tests were achieving higher scores. The superiority of daily testing was retained on the final examination and on a performance test at the end of the course. There were some significant teacher-treatment interactions.

Nelson, Orville William. A Framework for Research in Industrial Arts Motor Learning. 1967.
A framework for research on motor learning in industrial arts was developed from a review of the literature. Four major variables were isolated and defined: learning environment, input, learner, and performance. Interaction effects among these variables were posited. It was suggested that research efforts focus on the problem areas identified in the framework, with the goal of developing higher order conceptual systems.

Neubauer, Gerhardt W. The Significance of Selected Aspects of Wood Technology for Western Culture. 1956.
The researcher compiled a detailed study of the effect of wooden housing, vehicles, implements, weapons, and furniture upon the development of Western Culture. The investigation covered the period from the dawn of civilization to the present, and concluded with a number of curricular recommendations for courses in history, humanities, and industrial arts.

Norman, Ralph Paul. An Experimental Investigation to Determine the Relative Effectiveness of Two Different Types of Teaching Methods in Engineering Drawing. 1955.
Two groups of students were taught engineering drawing for nine weeks, one group making all drawings with instruments, the other working freehand for the first five weeks, then

using instruments for four weeks. The group doing freehand drawing obtained higher scores than the group drawing only with instruments on an engineering drawing test at the end of the fifth week, and again at the end of the study. The group doing freehand drawing attained higher scores on a freehand drawing test at the end of the course, and did equally well on an instrument drawing test at the end of the course.

Pucel, David Joseph. The Relative Effectiveness of the Traditional and Two Modified Methods of Organizing Information Sheets. 1966.
Three types of information sheets were administered to groups of high and low ability. The traditional instruction sheet was modified by adding an introductory paragraph to summarize the information, relate it to previous learning, and supply an internal organization. In one instance, this organizer was expository; in the other modification, the organizer was in question form. Groups receiving the three forms of instruction sheet performed equally well on tests of initial learning, retention, and transfer. Differences between ability groups were consistently significant on all measures.

Randleman, Robert Ronald. Technical Vocabulary and its Relationships to Selected Student Characteristics and Industrial Education Programs. 1961.
A 180-item technical vocabulary test was developed to cover nine industrial education areas of instruction. This instrument was used in the attempt to identify relationships between technical vocabularies of students in grades nine through 12 and scholastic ability, scholastic achievement, grade level, and instruction in industrial arts and science. Grade level, scholastic ability, and science courses were positively related to technical vocabulary. However, industrial arts courses did not make significant contributions, and unidentified factors accounted for substantial portions of the technical vocabularies.

Ruehl, Philip William. An Experiment in the Use of an Auto Instructional Aid in Teaching Electricity. 1961.
Students in beginning college electricity courses solved 120 mathematical problems dealing with the application of basic electrical laws. One group had access to an automatic comparator which would inform them when their answer was correct. The other group turned in papers for correction by the instructor and return the following day. Students who used the automatic comparator attained higher test scores at the end of the nine-week course. This difference was not maintained when retention was tested eight weeks later.

Sayovitz, Joseph John. Certification Status and Procedures for Industrial Arts Teachers in the United States: Agencies, Types of Certificates, Rulings and Practices, State and Regional Comparisons, and Reciprocity, with Suggestions for Improved Patterns. 1955.

A questionnaire, correspondence, and a study of state certification literature were used to obtain data. Course requirements, certification methods, types of certificates, and other factors in state requirements were studied in detail and tabulated in the report. A number of areas of agreement were noted, yet considerable diversity characterized the requirements.

Smith, Brandon B. Testing an Empirical Procedure for Identifying Technical Associative Conceptual Structure: Discriminating Between Flexible and Inflexible Radio and Television Repairmen. 1968.
This study tested the validity of an empirical (free association) procedure for identifying and discriminating between the structure of technical concepts possessed by a purposive sample of two qualitatively different groups of electronic repairmen. Based upon their associative responses to a sample of major technical stimulus words, a hierarchical structure of technical concepts for each group was identified and compared. The free association technique was found to be a reliable and valid methodology for identifying a criterion structure of technical content.

Sommers, Wesley Sherran. The Influence of Selected Teaching Methods on the Development of Creative Thinking. 1961.
Students enrolled in a college freehand drawing course were instructed by one of two methods: 1) standard sequence of learning activities, or 2) creative learning activities which were substituted for some of the standard activities. Students who received their instruction through the creative learning activities demonstrated significantly greater gains between pretest and posttest scores on tests of subject matter information and creative thinking.

Steele, Gerald Lee. A Comparison of Plastics Concepts Learned Using Educational Toys and Three Dimensional Mock-Ups and Concepts Learned Using Commercial Plastics Processing Equipment. 1967.
Students in two schools were exposed to experiences designed to develop concepts about plastics by two means: commercial plastics equipment and educational toys. Better results were obtained using the commercial equipment, apparently at least partly due to motivational problems when the educational toys were used.

Svendsen, Ethan Andrew Tange. The Matrix of a Philosophy for Industrial Arts Education: Some Implications for the Status of Modern Industrial Arts Education of Certain Antecedents in Educational Philosophy and Psychology. 1961.
The study focused upon the development of industrial education in secondary schools. The concepts of physical activity and reflective thought were explored, and criteria for evaluation were developed. Generalizations were proposed as guides for reorganization, development, and promotion of industrial arts education at all educational levels. Modern extensions of Dewey's educational thought were emphasized.

Swanson, Robert Sterling. The Operational Definition and Measurement of Educational Philosophy. 1955.
The researcher developed an instrument to measure the extremeness and emphasis of a teacher's educational philosophy. Paired statements (one representing an essentialist point of view, the other a progressive) were presented in the inventory, with instructions to select the statement of each pair most in accord with one's own beliefs. The inventory was effective in differentiating between individuals possessing essentialist viewpoints and those holding progressive viewpoints in the experimental group of graduate students at three universities.

Taylor, Cyrus Byrdart. Mechanic Arts Programs in Land-Grant Colleges Established for Negroes: A Study of the Types and Status of the Programs Operating and an Analysis of Selected Factors that Influenced the Development of These Programs. 1955.
Interviews, visits, and questionnaires were used to ascertain the status and types of mechanic arts programs in operation in land-grant colleges that had been established for Negroes. These institutions were found to be in positions of leadership in the education of Negroes, despite problems with facilities and funding. Areas of possible re-direction of the programs of these land-grant colleges were suggested.

Wigen, Ray Arthur. Technical Offerings for Industrial Arts Teachers at the Graduate Level. 1957.
Identifiable general theories of graduate work provided the bases for the development of a checklist guide for developing and evaluating technical offerings. The constructive criticisms of 50 directors of industrial arts graduate programs also provided developmental data. The guide performed effectively in subsequent application in 12 settings.

Worthington, Robert Melvin. Factors Affecting the Delayed Imitation of a Demonstrated Psychomotor Skill. 1958.
Subjects were taught a simple assembly task and a complex assembly task under 14 experimental variations of these factors: demonstrations, verbalization, delay, and levels of delay. Demonstrations significantly reduced learning time, and to a greater degree for the complex task than for the simple task. Factors of verbalization and delay did not significantly affect the speed of learning.

UNIVERSITY OF MISSOURI

Ainsworth, Chester B. Relation of Industrial Arts Instruction to Practices Followed by Adults in the Selection, Care, and Use of Tools. 1956.
Male high school graduates who had established homes were studied to see if industrial arts experiences affected their adult tool-using activities. Men who had completed at least two years of high school industrial arts were

more interested in working with tools; followed better practices in cleaning, sharpening, and maintaining tools; and did more lawn mower and automobile maintenance than men who had no high school industrial arts. No significant differences were identified on several other criteria.

Bailey, Gerald D. Foundry Technology, A Technological Research and Curriculum Analysis, With Implications for Junior High School Industrial Arts. 1964.
Technical literature was reviewed to identify technical foundry content. Teachers were surveyed to determine the foundry content of junior high school industrial arts courses. While content dealing with foundry technology was considered to be appropriate for industrial arts courses, only about one-third of the courses included foundry activities; these typically worked only with aluminum and did not use plastics in patternmaking.

Bailey, James H. Relation of Instruction in Industrial Arts to Knowledge of Design. 1961.
A test on design was administered to a total of 806 high school senior boys with varying amounts of industrial arts. There was no general increase in design scores paralleling an increase in units of industrial arts. Students who elected the larger number of industrial arts courses tended to be of lower intelligence and to possess lower scholastic ability.

Baugrud, Kim J. Industrial Education for the Visually Limited: The Teacher and His Approaches to Instruction in the Residential School. 1968.
Industrial education teachers of the visually limited completed a self-reporting form to provide data on their professional preparation and personal characteristics. Recommendations of specialists in the education of the visually handicapped and the actual instructional approaches used by the teachers were found to be closely related. Additional attention to professional improvement of the teachers was recommended.

Beach, Robert B. An Analysis of the Missouri Industrial Education Awards Program With Implications for Future Programs. 1967.
Industrial education students and teachers, coordinating committee members, awards chairmen, and undergraduate industrial teacher education majors provided data for the study. The awards program was found to be effective in promoting and upgrading industrial education among participating students and teachers. However, the scholarship program was not judged to be effective in attracting students to industrial education teaching, and the awards program did not appear to influence the selection of an undergraduate major.

Beck, Burrel H. A Comparison of the Achievement Level of College Men and Women Enrolled in Engineering Drawing. 1967.

Men and women enrolled in engineering drawing were compared on a number of relevant variables. There were no significant differences between the groups in performance time, visualization of spatial relationships, and attitude toward engineering drawing. Men made significantly greater achievement than women in the acquisition of technical information and in manipulative skill development.

Beck, Eugene J. A Comparison of Two Approaches to Teaching Selected Elements of College Level Descriptive Geometry. 1968.
Students enrolled in a college descriptive geometry course were taught by two methods: 1) a directed problem analysis approach in which the students attempted to identify the steps in solutions and sketch tentative solutions to problems, and 2) a traditional approach in which problem solutions were attempted without written or graphical analysis. The two approaches resulted in a similar gain in informational achievement and behavioral change.

Bednar, Ernest G. Public School Maintenance, Installation, and Construction Jobs Performed by or Under the Direction of Industrial Arts Teachers. 1955.
Returns from 392 public school industrial arts teachers were analyzed. Industrial arts teachers and their students were frequently responsible for maintenance and construction tasks during class time, during vacant periods, and after school hours. Specific recommendations were made for courses in maintenance and the management of maintenance and construction activities.

Bell, Charles L. Status of and Need for Industrial Arts in the Public Schools of Kansas with Implications for Teacher Education. 1964.
Information forms submitted by 701 industrial arts teachers in Kansas provided data concerning the junior high school and senior high school programs. A jury of 12 industrial arts educators completed a rating scale; their ratings provided the paradigm for an ideal program. Suggestions were made for the revision of the existing programs to provide more adequate programs.

Bell, Claude A. A Comparison of the American Industrial Arts Association and the Industrial Arts Division of the American Vocational Association with Opinions Concerning Certain Issues in Industrial Arts. 1964.
The files and publications of the American Industrial Arts Association and the American Vocational Association were examined, and an information form from industrial educators provided data. The purposes of the Industrial Arts Division of AVA and the AIAA were considered to be substantially the same. Their programs, participants, convention exhibitors, and publications revealed marked similarity. Closer cooperation and possible unification were recommended.

Brenner, Charles J. An Experimental Comparison of Direct-Detailed Versus Directed Discovery Laboratory Exercises in Teaching Selected Elements of Basic Electricity. 1968.
A sample of 120 college students were taught by two methods: directed discovery, in which the student was required to design a laboratory procedure to solve a problem or prove electrical relationships; or direct-detailed, in which the student was required to follow prescribed laboratory assignments. The directed discovery approach was significantly superior to the direct-detailed approach in terms of performance in solving electrical problems. The two methods were equally effective in terms of immediate learning and retention, and student attitudes toward basic electricity.

Brown, George J. Manipulative Operations and Electronics Equipment Needed in Industrial Teacher Education Based on Industrial Practices. 1960.
Representatives of electronics manufacturing industries, repairmen and technicians, and college instructors of electricity and electronics provided information used in the study. The industrial applications of equipment and operations and the course coverage of these items were compared and found to be similar in most instances.

Brownrigg, Jerry R. Reading Abilities in College Drafting Students Compared with Readability of Drafting Textbooks and with Informational Achievement in Drafting. 1962.
Reading abilities of beginning college drafting students were compared with the readability levels of drafting textbooks and with achievement in drafting. The Dale-Chall Formula rating of samples from textbooks varied widely, with numerous samples rated as too difficult for the students' reading ability. Reading ability and informational achievement had a substantial positive relationship.

Bruce, Phillip L. Status, Content, and Appraisal of Industrial Arts Courses for Elementary Teacher Education in Public Higher Educational Institutions. 1964.
Industrial education department chairmen and instructors of industrial arts courses for elementary teachers reported on the content of their courses and the clientele served. The courses were considered to be generally adequate. Some specific suggestions for improvement were included.

Bunten, Charles A. Selecting, Purchasing, Issuing, Financing, and Accounting for Industrial Arts Supplies in the Secondary Schools of Missouri. 1955.
Industrial arts teachers and specialists were surveyed to ascertain the practices used in the procurement and management of industrial arts supplies in Missouri, costs and problems of financing industrial arts supplies, and the extent to which current practices coincided with recommended practices. Kansas City and St. Louis schools were found to be following the practices recommended by specialists more closely than schools in the remainder of the state.

Burdette, Walter E. The Contribution of Industrial Arts Instruction to the Consumer Knowledge Possessed by Students of Central Minnesota. 1955.
High school senior boys were queried to ascertain the extent to which industrial arts instruction contributed to consumer knowledge concerning the selection, use, and care of industrial products. Industrial arts instruction was found to be moderately successful in improving consumer knowledge.

Crouch, J. Page. An Appraisal of the 1967 National Defense Education Act Institutes for Advanced Study in Industrial Arts and Their Impact Upon Professional Activities of Participants and Directors. 1968.
Directors and participants supplied information for analysis in the study. The institute programs were considered to have influenced the instructional programs and the professional activities of both the directors and the participants. The 1967 institute instructional programs were of high quality and provided for superior relationships among participants. Stipends were considered to be essential; graduate credit was of less importance in attracting institute participants.

Daines, James R. The Effect of Test Difficulty on Informational Achievement in a Technical Industrial Education Course at the College Level. 1968.
College students in a power mechanics course were subjected to one of two testing conditions: low difficulty or high difficulty levels on four unit achievement examinations. Gains associated with the low difficulty testing approach were significantly higher than those attributed to the high difficulty approach; this difference was most marked for high ability students. The treatments exhibited similar effects upon test situational anxiety change and upon attitude toward the course.

Doane, Raymond C. Industrial Education in Selected State Schools for the Deaf. 1956.
The status and need for industrial education at state schools for the deaf of the upper Mississippi Valley region was studied by means of check lists, interview schedules, and information forms. The occupational success of graduates was quite comparable to that achieved by hearing employees. A wide variety of specific suggestions were offered for program improvement.

Downs, William A. The Effect of Constructional Activities Upon Achievement in the Areas of Science and Mathematics at the Fifth Grade Level. 1968
Fifth grade students studying a science unit on birds received one of three methods of instruction: 1) a constructional activity directly related to the unit; 2) a constructional activity related to mathematics; or 3) a traditional method using no constructional activities. Students who experienced the constructional activity directly related to the science unit attained the highest gain scores; they also learned and retained mathematics as well as students whose constructional activities were in mathematics.

Drake, Lawrence C. The Effectiveness of a Selected Readability Formula in the Prediction of Student Success with Technical and Non-Technical Reading Materials. 1966.
Information sheets on technical content and non-technical content were written at the 10th grade level of readability and rewritten at the fifth grade level of readability, as indicated by the Dale-Chall formula. Seventh grade students read the materials and were tested for comprehension and retention. The two levels of readability were equally effective in terms of comprehension, retention, and reading speed of students. This was revealed for the technical and the non-technical information sheet.

Ellis, Neil G. An Experimental Comparison of the Construction Method and the Workbook Method of Teaching Drafting. 1966.
Two groups, consisting of two sections each, were exposed to the construction method of drawing and to the workbook method of drawing for two equal periods of time in a college drafting course. No significant differences were found between the methods in terms of gains in informational achievement, understanding of spatial relationships, or attitude toward drafting. The workbook method was more effective than the construction method in the development of drafting skills.

Ensman, Leo M. Relation of Interests, Ability, Courses Taken, Scholastic Achievement, and other Factors to Success in Industrial Arts Teaching. 1957.
Teaching success, as rated by supervisors of 110 beginning industrial arts teachers who were graduated from Kansas State Teachers College of Pittsburg, was compared to the following factors: general and pre-college background, collegiate preparation, selected interests, mental abilities, and the school, community, and teaching assignment. A combination of the factors under study was found to affect the ratings more than any individual factors.

Farr, Wilbur J. Educational Needs of Urban Residents Concerning the Use of Electricity in the Home. 1958.
Interviews with 200 fathers of high school students indicated the importance of familiarity with everyday applications of electric power in the home. Minor repair and maintenance tasks; selection, operation, and care of electrical equipment; and planning for the use of electricity were considered to be important areas for course coverage.

Gaines, Thomas R. Relation of Work Experience in Industry to Industrial Arts Teaching Practices and Success. 1955.
Teachers provided information on the amount and type of their industrial work experience and the teaching practices they followed in their classes. Local industrial arts supervisors rated the teaching success of the teachers, and industrial arts teacher educators rated the teaching practices used by the teachers. There was little or no relationship between the teaching practices used or the supervisory ratings attained by the teachers and industrial work experience by industrial arts teachers.

Gerber, Russell L. Materials and Processes of the Furniture Manufacturing Industry with Implications for Woodworking Courses in Teacher-Education Institutions. 1966.
Interviews were conducted in eight wood furniture manufacturing companies, and 133 instructors of woodworking in industrial teacher education institutions responded to a questionnaire. In most instances, the two groups were using quite similar practices.

Ginther, Richard E. An Analysis of, and Opinions Concerning, Graduate Programs in Industrial Education. 1964.
Information forms and college catalogs were used to ascertain in what ways and to what extent specialized technical competencies, research competencies, teaching and administrative competencies, and provisions for general and liberal education were being provided for and developed in graduate programs of industrial education in the United States.

Hammack, Charles R. Effectiveness of Personnel Policies and Practices Employed by Department Chairmen and Satisfaction of Industrial Teacher Education Faculty Members. 1967.
A total of 200 department chairmen provided information on the personnel practices they employed and the relative effectiveness of the practices. Data were also obtained from three groups of faculty members: new appointees, remainees, and resignees. Major areas of dissatisfaction and generally satisfactory prodedures were identified, and differences between the opinions of the faculty groups were examined in detail.

Hammond, Robert G. Evolving Concepts of Industrial Education in the Thinking of the Industrial Educator. 1956.
Publications of individuals, governmental agencies, and professional organizations were examined to trace the evolution of underlying concepts of industrial education. Particular attention was given to the interpretation of the positions of industrial educators toward the major issues in industrial education as it developed in the United States.

Hampton, Isaac P. Amateur Radio Operation in Missouri, and Its Implications for Industrial Arts Education. 1959.
Amateur radio operators provided information concerning their experiences, viewpoints, and activities. Most of the operators had acquired information about their hobby through independent reading and study. They did not advocate including instruction in amateur radio operation in the public schools.

Hansson, Kenneth S. Sloyd, Pre-vocational, Vocational, and Technical Education in Sweden. 1966.
Swedish libraries and schools were visited and teachers and administrators were interviewed to obtain data for the study. The development of contemporary programs in sloyd, prevocational, and technical education was studied and described in detail.

Hepler, Earl R. Order of Presenting Orthographic Projection and Pictorial Representation and its Effect on Achievement in Engineering Drawing. 1957.
Matched groups of college engineering drawing students were taught by one of two sequences: 1) orthographic projection followed by pictorial representation, or 2) pictorial representation followed by orthographic projection. The first method, with orthographic projection preceding pictorial representation, was superior in terms of informational achievement, the development of drawing skill, and the development of the ability to visualize. The sequences were equally effective in terms of speed developed in drawing and attitudes toward drawing.

Hofer, Armand G. An Experimental Comparison of Self-Instructional Materials and Demonstrations in the Teaching of Manipulative Operations in Industrial Arts. 1963.
Four groups of metalworking operations (foundry, copper enameling, drilling and counterboring, and threading) were taught to 50 seventh grade boys by alternating methods of presentation: demonstrations and self-instructional booklets including instructions and photographs. The two presentation methods were equally effective in terms of informational achievement, retention, and the quality of work completed. The self-instruction materials required more student time for instruction, but reduced the amount of individual assistance required from the instructor.

Horine, John W. Relation of Experience in High School Drafting to Achievement in Engineering Drawing at the College Level. 1961.
The relationship between high school drafting experience and success in college engineering drawing at six colleges was investigated. Students with high school drafting experiences demonstrated higher levels of skill development, improved ability to visualize, and higher final grades than students with no high school drafting. Informational achievement and attitude toward college engineering drawing were not related to experiences in high school drafting.

Jelden, David L. Electrical Informational Content Included in Industrial Arts Teacher-Education Versus Knowledge Required of Electronic Technicians. 1960.
The informational content of textbooks and other instructional materials used in electrical courses offered to industrial arts majors in teacher-education institutions was compared with the basic electrical knowledge required of persons who work with electronic devices in industry. Substantial agreement was expressed on two-thirds of the topics.

Johnson, Verner B. Supervision of Student Teaching in Industrial Arts: Personnel and Practices. 1966.
A total of 270 supervisors of student teachers indicated the extent to which they used 156 practices in supervising industrial arts student teachers. Most of the practices were regarded as desirable; only 14 were not recommended. Some differences in supervisory patterns were noted between supervisors with industrial arts backgrounds and those who did not have preparation in industrial arts.

Johnston, John L. Teacher-Demonstrations Versus Shop Activities in the Teaching of Electricity: An Experimental Comparison. 1956.
A college course in basic electricity was presented to matched groups of students by two methods: instructor demonstrations and shop activities. The demonstration method resulted in superior knowledge acquisition, reduced expense, and less effort on the part of the instructor. The two methods did not differ significantly in terms of student attitude toward the subject.

Keseman, Charles E. A Comparison of the Effect of Three Evaluation Approaches Upon Student Achievement in College Level Drafting. 1967.
Drafting assignments in a college course were evaluated by one of three methods: 1) student self-evaluation; 2) instructor selective evaluation, in which 25 percent of the assignments were graded; and 3) instructor total evaluation. The three methods were equally effective in improving informational achievement and a positive attitude toward drafting. The student self-evaluation approach required less instructor time than the other methods.

Kigin, Denis J. Tort Liability Affecting Shop Teachers with Provisions for Avoiding Accidents and Litigation. 1959.
This study investigated methods of accident prevention, appropriate forms of legal protection for teachers, and the extent to which teachers were held liable in court actions stemming from classroom accidents. It was concluded that the teacher should have the welfare of pupils at heart, properly instruct them in the use of equipment, maintain a safety program, and remain in the room with the class.

Kirby, Jack. Problems of Beginning Industrial Arts Teachers in Missouri with Implications for Preparatory and Inservice Teacher Education. 1965.
Beginning industrial arts teachers and their supervisors were interviewed to identify problems encountered by teachers and investigate possible solutions to the problems. Discipline, project selection, and economic conditions of students and school districts were important problem areas. Suggestions for improvements in teacher education programs and in supervisory practices were included.

Kleinbach, Merlin H. Physical and Biological Science Material Incorporated in Textbooks for General Shop. 1959.
Nineteen general shop textbooks were evaluated in terms of the applications of 409 principles of physical and biological science. The majority of the prinicples did not appear in the general shop textbooks. Electricity included the largest number of principles, followed by metalworking, transportation, woodworking, and graphic arts.

Koonce, Tommy R. State Prepared Industrial Arts Resource Materials: Their Status, Preparation, and Effectiveness. 1968.
State department personnel provided information as well as

a total of 106 resource publications for examination, and 1288 industrial arts teachers provided information for the study. The materials offered by state departments of education were used largely within the state where they were prepared, and were not usually considered fuctional for direct classroom use.

Lloyd, Clifford J. Utilization of Constructional Activities in the Elementary Classroom by Graduates of the University of Missouri-Columbia. 1968.
Recent graduates in elementary education and special education reported their classroom activities; these were contrasted with the academic preparation received by the teachers. The teachers were considered to be inadequately prepared for implementing a constructional activity program. Specialized preparation and indirect experiences assisted teachers in implementing constructional activities programs.

McArthur, Ross J. Selection and Management of Industrial Arts Equipment in the Secondary Schools of Missouri. 1955.
Industrial arts teachers provided information on the major items of equipment in their facilities and the practices they used in equipping shops and maintaining their equipment. Teacher educators recommended practices and procedures; these were compared with actual practice and points of difference were discussed.

McMurry, James G. An Experimental Comparison of Self-Instructional Materials Versus Traditional Methods in Teaching Related Information in the Comprehensive General Shop. 1964.
A nine-week unit of related information was taught to matched groups of eighth and ninth grade students by two methods: 1) informational assignment sheets and class discussion; and 2) self-instruction by means of a linear programmed textbook, with no classroom discussion. No significant differences were found between the two groups in terms of informational achievement or attitude toward the course. The programmed textbook required less instructor presentation time but considerably more preparation time.

Mahoney, James H. State Instructional Materials in Industrial Arts: Their Status, Content, Preparation and Use. 1956.
The status, content, preparation, and use of industrial arts instructional materials prepared under the leadership of of state departments of education were studied. Data for the study were obtained through an analysis of state prepared industrial arts publications, and through letters and information forms from representatives of the 48 state departments of education.

Miller, Thomas W. Origin and Development of Machines Used in School Shops. 1958.
This study traced the development of the power operated wood and metal working machines used in school shops. The machines included in the study were arranged in four machine groups: 1) turning; 2) sawing; 3) planing, shaping, and milling; and 4) drilling, mortising, routing, grinding, and sanding.

Miller, Wilbur R. Levels of Readability of General Shop Textbooks Compared with the Reading Abilities of Ninth Grade Industrial Arts Students. 1960.
The readability of general shop textbooks used on the ninth grade level was compared with the reading abilities of ninth grade industrial arts students. Data were obtained through the application of the Dale-Chall and Flesch formulas of readability to the content of five general shop textbooks and from the results of tests of reading ability. The readability ratings by the two formulas were in close agreement; however, large portions of the books were too difficult for the majority of ninth grade students.

Nelson, A. Frank. Follow-Up Study of Industrial Arts Graduates of North Texas State College. 1955.
The professional status and location of the industrial arts graduates of North Texas State College were studied to obtain some measure of the effectiveness of the training they received, to secure their suggestions for the imporvement of the program of industrial arts at the college, and furnish, on the basis of the evaluations, data which might justify changes in the present program.

Pankowski, Dallas J. An Analytical Study of the Content of Four Selected Junior-Senior High School Electricity-Electronic Teaching Systems with Recommendations by Electrical Specialists. 1966.
The content of four electricity-electronic teaching systems was compared with that recommended by electrical specialists. The textbooks and laboratory manuals of the teaching systems under study were analyzed for electrical principles, manipulative operations, electrical test equipment, and readability of printed materials. Redesign of existing systems was suggested to: 1) include more electrical principles, 2) include more test equipment, and 3) design each system for a specific level of instruction.

Porter, Sam R. An Appraisal of the Ford Motor Company's Industrial Arts Awards Competition, 1951 Through 1960. 1962.
Data were secured from the records of the Ford Motor Company, and from information forms completed by award winners, parents of award winners, industrial education instructors, and secondary school principals. Most principals and instructors favored the program and recommended a more selective competition.

Powers, G. Pat. Relationship of Scholastic Attainment to Rated Success of Experienced Industrial Arts Teachers. 1961.
Ratings of teaching success were obtained from 21 supervisors of 200 industrial arts teachers who had an average of 20 years of experience. Rated teaching success was correlated .32 with grades in undergraduate technical courses, .52 with grades in academic courses, .51 with grades in professional education courses, and .51 with the total undergraduate scholastic index.

Randel, Stephen V. A Comaprison of Drafting Practices in Industry with Drafting As Taught in Engineering Schools. 1957.
Chief draftsmen in machinery manufacturing firms and engineering school drafting instructors provided information on the relative empahsis and frequency of use of drafting practices. Areas of descrepancy were noted, examined, and described.

Robinson, Frank E. Background of Prospective Elementary Teachers in Selected Industrial Arts Activities. 1955.
Information was obtained from 135 college seniors majoring in elementary education. Their pre-college experiences were considered inadequate for industrial arts activity areas: pottery, woodworking, and weaving competencies needed to be developed in college courses.

Runnalls, James J. Plastics Technology and Its Reflection in Industrial Arts Teacher-Education Programs. 1965.
A study of literature identified a body of knowledge concerning the production processes and materials in the plastics industry. A maximum of one course in plastics was offered at the 61 teacher education institutions identified as offering courses; only 14 institutions required a course in plastics. Another 73 institutions offered units in plastics in comprehensive courses; these were not as comprehensive or up-to-date as the separate courses in plastics.

Schanbacher, Eugene M. Identification and Analysis of Elements Versus the Conventional Approach in Teaching Drafting. 1961.
Beginning drafting students under two teachers were taught a 12-week unit by two methods: 1) instruction in isolating and analyzing elements in drafting, with practice; and 2) no mention of the identification and analysis of elements. The two methods were equally effective in terms of informational achievement, quantity and quality of drawing, ability to visualize, ability to solve sketching problems, and attitude toward the course. The group which identified and analyzed elements did complete more accurately solved sketching problems than the other group.

Scherer, Harlan L. Procedures and Factors Involved in the Selection of Industrial Arts Teachers and their Relationship to Rated Teaching Success. 1960.
Recruitment procedures used in school systems were identified by the administrators responsible for hiring teachers; teacher ratings were obtained from supervisors and principals. Selection factors which were related to teaching effectiveness ratings were scholarship in professional education courses and the involvement in graduate work. Written examinations, interviews, inquiries, personality, professional attitude, and ratings in student teaching were not significantly related to ratings of teaching effectiveness.

Senteney, George W. Factors Relating to the Choice of Industrial Education as a Career and the Retention of these Teachers in the Profession. 1955.
A total of 1356 graduates of 64 industrial teacher education

programs supplied personal and professional data for the study. The graduates who were more likely to enter and remain in teaching were those from small communities whose fathers were employed in agriculture. High school shop experience, work experience, and an interest in industrial education influenced students to enter industrial teacher education programs in college. Salaries were higher for those graduates who were in occupations other than teaching.

Sexton, William E. Design Instruction in Industrial Arts Teacher-Education: A Curriculum Analysis with Opinions of Educators, Instruction Specialists, and Industrial Designers Regarding Content and Insturctional Practices. 1965.
A design information form was prepared from an analysis of design literature, and forms were mailed to design educators, design instruction specialists, and professional industrial designers. It was concluded, on the basis of the information obtained, that the formal preparation of industrial arts teachers was inadequate in the area of design, and that there was general agreement on a core of content essential for effective design instruction.

Singletary, Thomas A. An Analysis of Metal Finishing Technology and Its Status in Industrial Teacher-Education. 1968.
The purpose of this investigation was to analyze and describe the technology of metal finishing and to ascertain its status in instructional programs of industrial teacher-education. Metal finishing technology was analyzed and described from technical publications, handbooks, and directories. Industrial teacher education programs were studied to obtain data on their instruction in metal finishing. It was concluded that instruction about metal finishing production processes and materials was not adequate, though processes were represented more frequently than materials. While resource materials were available, many teachers were not familiar with them, and they lacked adequate equipment to portray industrial metal finishing processes.

Spence, William P. Job Planning in Shop Teaching: An Experimental Comparison of Two Approaches. 1957.
Four classes of seventh grade general shop were divided into two equated groups. One group started work, following teacher-planned job assignments; the other group participated in teacher guided planning sessions to complete their job assignments. The two approaches were equally successful in terms of information achievement, skill development, quality of work, number of errors, economy in the use of materials, and ability to plan procedures. The pupil-planning approach was better for increasing the ability to read drawings, though it resulted in the accomplishment of less work; it did develop a more favorable attitude toward the course.

Spinti, Robert J. The Development of Trade and Industrial Education in Wisconsin. 1968.
This study compiled the history of trade and industrial education in Wisconsin into one organized treatise by

tracing the development of significant aspects of this phase of education from its origin until 1967.

Thomas, Joseph K. Use and Effectiveness of Public Relations Practices in the Interpretation of Industrial Arts in Selected Secondary Schools of California. 1957.
The use and effectiveness of public relations practices by teachers who actively interpreted their industrial arts programs was compared with the practices of teachers who did less interpretation. Teachers who were more active in school and professional activities were also more active in public relations for their programs. Teachers tended to overrate the effectiveness of their public relations programs, which could have been improved by using more effective media and practices.

Torbett, Daniel L. An Analysis of General Drafting Instruction in Missouri Secondary Schools with Implications for Advanced Placement in College Level Drafting Programs. 1965.
Information was obtained from 100 high schools, and standardized drafting tests were completed by 1524 students. A common body of content made up the major portion of the high school general drafting courses, and college drafting instructors were in general agreement that the content was appropriate. High school students of high general ability who had completed a drawing course attained test performance comparable to that of students who had completed the college basic drafting course.

Vanherck, Don V. Constructional Activities: Their Status and Factors Relating to Their Utilization by Public Elementary School Teachers of Missouri. 1966.
Information was obtained from elementary teachers and administrators concerning the status of constructional activities in grades one through six. Educators emphasized the importance of effective outcomes resulting from constructive activities. Over 80 percent of the teachers included constructional activities in their programs; however, facilities, tools, and equipment were quite limited.

Wallis, Donald E. Status of and Direction for Industrial Arts in the Public Schools of Missouri with Implications for Teacher Education. 1965.
Data on existing industrial arts programs were obtained from 633 industrial arts teachers; a jury of 54 industrial arts educators completed a rating scale dealing with the desirable industrial arts program. Wide variations were found in the industrial arts programs. General shop and general drafting were the courses most often taught. Specific suggestions were made for program revision to improve the correspondence with the desirable program, and suggestions for the teacher education program were provided.

Wilkes, Doran F. A Comparison of Two Approaches to the Teaching of Engineering Drawing: Film Slides Versus the Conventional Approach. 1966.
Students in a college-level course in engineering drawing

were taught by two methods: 1) sketching on the chalkboard; and 2) 35mm film slides. The two methods were equally effective in terms of the quality or work completed. However, the method utilizing slide presentations was more effective in terms of informational achievement, improvement of the ability to visualize, quantity of work completed, student attitudes, and instructional time requirements.

Wills, Vernon L. Effect of Teaching Procedures Emphasizing Speed of Performance Upon Educational Achievement: An Experimental Investigation. 1964.
Beginning metalworking students were subjected to two types of educational pressure: 1) conventional, and 2) speed-up teaching procedures. The two methods were equally effective in teaching informational content, produced work of equal quality, and produced similar attitudes. However, the emphasis upon speed of performance resulted in more errors and the use of more materials than the conventional conditions.

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Ball, Charles E. Filmed Demonstrations for Industrial Arts. 1958.
Demonstrations of 22 manipulative operations in industrial arts were recorded on 16mm black and white sound film. An evaluation sheet covering 17 factors was used by a jury in assessing the probable value of the films. The production of the films was viewed as a logical first phase in a larger process of evaluating the effectiveness of the films in teaching manipulative skills in industrial arts.

Bauer, Carlton Edward. A Study of the Arts and Crafts Movement and of Art Nouveau in Relation to Industrial Arts Design. 1955.
The Arts and Crafts Movement, Art Nouveau, and the Manual Training Movement were studied with respect to 1) their aims and objectives, 2) the identities and characteristics of their leaders, 3) their accomplishments and shortcomings, and 4) the relationships between the movements and the existing culture.

Benson, Kenneth R. A Manual of Craft Activities for Summer Playground Leaders and Camp Counselors. 1956.
The characteristics of children aged six to 15, the types of camp and playground programs, and the backgrounds of the program leaders provided sources for the development of criteria for the selection of craft projects. Forty projects were selected by a jury from a group of 100 projects which met the criteria; these 40 were incorporated in a crafts manual for use by playground leaders and camp counselors.

Christoffel, Frederick W. A Student Teaching Handbook for Cooperating Teachers in the Area of Industrial Arts. 1960.
Questionnaires were sent to student teachers, first year teachers, and cooperating teachers in four states asking for an evaluation of the frequency of occurrence of

techniques used in indoctrinating student teachers. Since most cooperating teachers had no specific preparation for their work and were relatively inexperienced, it was considered important for them to have a guide to assist them in providing desirable student teaching activities. The handbook which was developed as a part of the study reflected the findings of the survey.

Ditlow, George H. The Comprehensive Industrial Arts Laboratory in the Preparation of Industrial Arts Teachers for the Public Schools. 1956.
Library research, a normative survey of industrial arts teachers and supervisors, and personal interviews were used to assess the status of industrial arts instruction. Areas of disparity between observed practice and recommended practice were identified. Suggestions for improvement were included.

Duffy, Joseph W. A Guide for the Fabrication of Pupil-Made Dioramas in the Junior High Schools of New York City. 1958.
Suitable curriculum topics for the inclusion of dioramas were identified. Step-by-step diorama fabrication instructions were prepared, and lists were provided of tools, materials, published resources, and local sources of needed supplies.

Engelbrekston, Sune. Industrial Arts: Its Application to Astronomy. 1961.
A list of astronomy topics was developed and validated as a representative cross-section of appropriate topics for junior high school students. A resource unit was then developed to include elements appropriate to industrial arts and to science education. The creative activities included industrial arts projects which could be used for astronomical observation.

Finkelstein, Abraham M. A Manual of Functional Lesson Presentations for Teachers of Industrial Arts, with Emphasis on Pupil Understanding. 1959.
Difficult demonstrations and informational lessons were selected from courses of study on the basis of teacher ratings. The content of the lessons was identified, validated, and organized for classroom presentation. A field trial indicated that the manual of lessons was functional and operationally valid.

Foley, Denis Joseph, Jr. Recruitment and Selection of Potential Industrial Arts Teachers. 1967.
Questionnaires were sent to heads of college departments including industrial arts teacher education to obtain data about successful recruiting practices. Visits to the college campus, booklets describing the profession, and speeches about industrial arts teaching were most frequently used, though there was no agreement upon which practices were most effective. Students in their first year of industrial arts teacher education at 12 institutions were questioned to determine what factors influenced their career decisions

and to learn about their perceptions of industrial arts teaching careers. Recruitment and selection of industrial arts teachers appeared to be a national problem which would require unified effort to resolve.

Golomb, Arthur E. A Guide to Plastics in the Industrial Arts Program of the Academic High Schools of New York City: An Evaluation of the Extent to which Plastics is Taught, and the Development of a Guide to Implement Plastics Education in Existing Shop Areas. 1962.
Developments in the plastics industry were studied, the philosophy of industrial arts was reviewed, and the status of plastics education in the academic high schools was determined by means of a questionnaire survey. The findings indicated the need for plastics education, recommended increased use of industrial methods, improved project design, more use of available visual aids, and modification of industrial equipment for educational purposes. The data from the study, interviews, and experimentation were utilized to prepare a guide for plastics education.

Kaplan, Harold. A Course of Study for Entrance Production Workers in the Radio Manufacturing Industry. 1956.
A course of study covering theory and shop work was developed to include the trade information and manipulative skills needed by entering production workers in radio manufacturing. Job analysis of the identified job classifications provided a structure for the course.

Krempa, John Steven. Industrial Arts Education in New York State, 1870 to 1965. 1966.
This study traced the development of industrial arts in New York from its introduction as manual training by Love in Jamestown in 1874. The philosophical support of Dewey and Bonser and the practical and organizational contributions of Sheldon and Fales were emphasized. Recommendations were made to assess the position of industrial arts at the time of the study and to point directions for its future.

Kroh, Damon Kieffer. Relationships of Industrial Arts to the Modern Elementary School Curriculum. 1957.
Interviews with teachers and amdinistrators, a survey, and a review of the literature were conducted. Recommendations were made for the improvement of the preparation of industrial arts teachers for the elementary schools, and a proposed teacher education curriculum was included.

Lichtblau, Leonard Robert. Slides for Perceptual-Motor Skills. 1958.
Six experimental factors were used to modify a series of 2" X 2" slides on how to set a rivet. Including an explanation of the reasons for an operation in the slides resulted in manipulative performances significantly poorer than the performances exhibited by subjects completing the unmodified sequence; the other five modifications did not produce significantly different results on the riveting exercise rated independently by three evaluators.

Ljostad, Rodney Allen. Industrial Arts Activities in the Enrichment of Science Experience for Elementary Schools. 1965.
A tentative list of objectives for industrial arts and science education in the elementary schools was developed. The list was submitted to a panel for the establishment of an approved list. The subject matter content of elementary school science was established through a content analysis of texts and courses of study. The instructional guide was compiled in 11 sections, with at least one item in each section having constructional activity. A total of 30 industrial arts projects were selected for the guide as typical of those which could be used to illustrate principles of science.

Paster, Julius. Historical Backgrounds and Pupil Activities in the Teaching of Industrial Arts in the Public Junior High Schools of New York City. 1959.
Junior high school industrial arts teachers were asked to respond to a questionnaire by indicating activities included in their programs, projects constructed which were related to the activities, and the contribution of the activities to objectives of industrial arts. Observations of junior high schools and interviews with teacher, supervisors, and administrators provided additional data for the series of conclusions.

Rich, Mildred Kroll. Handcrafts for the Homebound Handicapped. 1958.
Homebound handicapped pupils were studied to determine the limitations placed upon their activities by the illnesses. In addition, data were obtained on interests, activities, hobbies, and needs for creative expression. A series of 30 projects was developed and arranged in an instructional guide for the homebound handicapped.

Salmon, Daniel A. The Development of a Teachers' Manual of Comprehensive Units for Industrial Arts Metalworking: An Investigation of Metalworking in School Programs and in the Local Industry, and the Development of a Manual for Teachers of Metalworking in Industrial Arts Education. 1965.
Current educational practices in teaching metalworking were studied by questioning heads of departments in the 50 largest cities. New York City metals industries were studied by correspondence and interviews, and from statistical data to determine employment opportunities and which phases of the industry should be included in the metalworking program. Analysis of curriculum guides indicated the need for a manual of comprehensive instructional units designed to help the teacher to provide a sound metalworking program. A manual of comprehensive units was developed and validated.

Seckendorf, Robert Sidney. The New York State Steering Committee for Industrial Arts. 1960.
This study explored the background of the Steering Committee during the period, 1900-1934, and then traced the growth of the Committee from 1934 through 1959. The report recommended that the Steering Committee continue as the coordinating body for industrial arts teacher clubs in the state and that member

clubs should be strengthened. Restatement and clarification of goals and purposes was suggested.

Snyder, Vance Beidel. Use of Teacher-Produced Instructional Films in Industrial Arts Education. 1960.
Groups of public school industrial arts students were equated on reading ability, mechanical ability, and previous industrial arts experience. One group received instructor demonstrations; the other received the same material by means of a teacher-produced film. Both groups constructed projects which required the demonstrated or filmed perceptual-motor skills; the projects were rated by a jury to evaluate 43 operations. In 32 of the comparisons, the groups performed equally well; in the other 11, the group receiving the demonstration did superior work.

Streichler, Jerry. The Consultant Industrial Designer in American Industry from 1927 to 1960. 1963.
Interviews and library research provided the data for the study of the development of the American industrial design movement. The study focused upon the role of the consultant industrial designer from the pioneer industrial designers through the recently-formed consultant industrial design services and professional societies. The rationale of industrial designing was explored, and integrated design techniques were described.

Trapanese, Menna Gerard. A Study of Facilities for the Crafts Program Conducted in Selected Elementary Schools in the State of New Jersey. 1964.
The literature was studied to develop a set of aims and objectives for crafts programs. Selected programs were studied to determine the status of crafts programs. The study recommended a crafts program integrated with other school activities, using laboratories staffed by trained personnel, with adequate supplies and equipment. Democratic procedures were advocated, and emphasis was placed upon the goals of creative expression, good workmanship, and the enjoyment of beauty and aesthetic expression.

Zankowich, Paul. The Craftsmen of Colonial New York City. 1956.
The political, social, and civic life in the city under British rule provided points of comparison with an account of the craft life of the time. Special consideration was given to the growth and development of the crafts, paralleling the development of the city, until the beginning of the Federal Period.

THE OHIO STATE UNIVERSITY

Bates, M. William. A Study of the NDEA Institute Creativity in Industrial Arts. 1968.
The effectiveness of the National Defense Education Act Institute, Creativity in Industrial Arts, conducted at Kent State University, Kent, Ohio, from June 19 to July 21, 1967, was evaluated in this study. Three questionnaires, as well as visitations with nine of the 25 participants, were analyzed in the collection of data. In final analysis, and in consideration of the accumulation of positive data through

the questionnaires, the review of literature, and in conclusion of the visitations, the writer stated that there had been a decided impact resulting from the NDEA Institute, Creativity in Industrial Arts.

Beatty, Charles Joseph. Museums of Industry. 1967.
A preliminary survey identified 43 museums owned and operated by a private industrial concern. Intensive study of a sample of 17 museums revealed a heavy emphasis upon manufacturing displays dealing with company products, their evolution and/or production. Company museums were considered to make unique, though limited, contributions toward the goals of industrial arts education, despite their lack of a well-developed pattern for educational participation.

Biedler, John Samuel. The Recreational Function of Industrial Arts Education, An Analysis of Position, Potential and Direction. 1958.
Documentary research, observation, correspondence, field experience, critical analysis, and interpretation were used to develop an evaluation of the recreational functions of industrial arts education. Recreation and industrial arts were considered to be coordinate movements. Increased recreational involvement of industrial arts types of activities was an expected outcome of increased technical development.

Brown, William Edwin. A Research Project Designed to Evaluate the Use of an Automated Teaching Device in the Instruction of Engineering Graphics. 1964.
One group of college engineering graphics students was taught by the traditional lecture-laboratory method. A second group received all new material from an automatic sound film strip projector, using cartridge magnetic tape and filmstrips as presentation media. On the basis of pretest to posttest achievement test gain scores, the null hypothesis of no difference between methods was rejected.

Chareonchai, Ruang. Industrial Arts in the Secondary Schools of Thailand. 1963.
A proposed industrial arts program for Thai schools was developed from a study of the professional literature and an analysis of the Thai educational setting. A questionnaire survey was employed to determine the existing status of the industrial arts program in Thailand. Problems in the existing program were identified, recommendations were made for possible solutions, and suggestions were offered for ways to work toward the proposed industrial arts program.

Clark, Donald Lee. Activity and Learning: An Experimental Comparison to Determine the Efficacy of Overt versus Covert Activity on the Learning of an Industrial Praxiological Concept. 1967.
A sample of 142 junior high school boys received instruction in the bending of electrical metallic tubing, with video tape as the presentation medium. After instruction, one group practiced the activity, while the other group conceptualized about how to do the activity. When performance test scores

were used as a criterion, the group with overt practice outperformed the group which had only conceptualized doing the activity. Several ability factors were identified as related to achievement on the performance task.

Crawford, Bryant, Jr. Industrial Arts Programs for Adults: A Study to Develop Procedures and Practices with Reference to Industrial Arts Programs with Implications for Adult Living. 1961.
Questionnaires were sent to directors to determine the extent of adult industrial arts programs and the impact of the programs in the communities. Industrial arts programs, as general education for adults, were contributing to skill development, recreational activities, the extension of educational opportunity, and to the development of personal and social characteristics. Specific program recommendations were not made, since these were considered to be dependent upon the needs and characteristics of the local community.

Deck, William Luther. A Resource Research in Electricity: for American Industrial Arts Education with Implications for Teacher Education. 1955.
The historical development of the use of electricity was explored. Subject matter in electricity was organized under 17 major headings. Proposed instructional units in electricity were presented for elementary, secondary, technical, adult, and service programs in industrial arts education. Recommendations were enumerated for teacher education, program implementation, and further research.

Doty, Charles Ransom. The Effect of Practice and Prior Knowledge of Educational Objectives on Performance. 1968.
A pretest, posttest, randomized factorial design was used with a sample of 190 seventh grade males who were taught to read and calculate the value and tolerance of carbon axial resistors. Students who received prior knowledge of the educational objective attained higher test scores than students who did not receive such knowledge. No significant differences in test scores resulted from practice with the actual referent objects as compared to practice with a symbolic referent, a written description.

Ecker, Louis Gene. The Status and Projection of a Teacher Education Program in Power Technology. 1965.
A survey of teacher education institutions identified 96 institutions offering programs in power mechanics. Examples of the automotive, power and transportation, and power mechanics philosophical positions were represented among the programs identified. A proposed power technology program was outlined, including a technical content outline for energy sources employed in prime movers, applications of scientific principles in power, and suggestions for research and development experiences.

Enzian, Harold James. Industrial Arts as Encouragement for Disadvantaged Youth. 1967.

The sample of the study was 195 students enrolled in one of seven occupational offerings in a Manpower Development and Training Program. About half of the students had graduated from high school; most were 18 or 19 years old and seeking a saleable skill. Industrial arts experiences helped the trainees in the use of tools, in solving problems, in understanding the world of work; and in understanding the organization of industry. Mechanical drawing experiences were considered to be most helpful, followed by metalworking. Little pre-vocational guidance had been included in the industrial arts courses taken by the respondents.

Fritz, Robert Charles. Ceramic Technology: A Technological Research and Curriculum Analysis with Implications for Industrial Education. 1960.
Technical, literary, and scientific books and periodicals were studied to gather information about the field of ceramics technology. A subject matter outline was derived to illustrate curricular elements which could be drawn from ceramics technology for application within the philosophical objectives for industrial education.

Gilbert, Harold G. An Industrial Arts Teacher Education Program for Elementary Schools. 1955.
A bibliographic study provided information for the development of an elementary school industrial arts program outline, with recommendations for a work center or workroom as a resource center. A questionnaire survey of elementary school administrators in New York State indicated that they favored the inclusion of industrial arts activities in the elementary school, with an industrial arts consultant to assist the regular classroom teachers. Teacher education programs for the preparation of industrial arts consultants were recommended, in addition to existing programs for elementary school teachers.

Hauenstein, Albert Dean. Construction: A Taxonomy and Syllabus of Production Practices with Implications for Industrial Arts. 1966.
Specific principles and criteria guided the development of a taxonomy of construction practices. The completed taxonomy included worker control, material handling, separating, combining, and forming practices under three headings: preprocessing, processing, and postprocessing. Four criteria guided the development of a course syllabus designed to exemplify the construction of any structure. The syllabus titles were: preparing the site, building the structure, completing the site, and postprocessing. Sample teaching materials were developed.

Hoots, William Ransom, Jr. Graphic Arts Education in the Public Schools of North Carolina, with Implications for Teacher Education. 1966.
Existing graphic arts programs in North Carolina schools were studied and compared with programs in the southeastern states and with the recommendations of a jury of professional leaders. Specific recommendations were made concerning state certification requirements and minimum program standards. Teacher

education institutions were encouraged to modify their curriculums to permit graphic arts experiences for all industrial arts majors and to make it possible for students to specialize in graphic arts.

Horton, George Richard. History of the Ohio Industrial Arts Association: An Analysis of Leadership Elements and Functions. 1967.
Library resources, association archives, observers, and association participants and leaders were consulted to obtain data concerning the founding of the Ohio Industrial Arts Association and its growth during the period 1955 to 1966. A number of recommendations for future action were formulated from the consensus of jury members who were consulted by a questionnaire.

Keith, Charles William. The Industrial Technology Program at Kent State University, An Appraisal and Recommendations. 1964.
Sixteen criteria were identified and validated as being applicable to industrial technology programs, as indicated by questionnaires completed by chairmen of industrial technology programs, technology program graduates, and industrial supervisors of the graduates. Appropriate recommendations were made to improve the existing program in terms of the criteria.

Larsen, Delmar Laverne. Industrial Management and Industrial Arts: A Resource Research with Implications for Curriculum Development. 1964.
Documentary research was used to identify management concepts and practices. Ten criteria were developed and used as guides in selecting concepts and practices for inclusion in industrial arts curriculum guides. The report included a list of management concepts considered to have implications for industrial arts, and suggestions for laboratory organization, field excursions, class reports and projects, a laboratory management center, and the use of resource personnel.

Mansfield, Robert Theodore. Competencies Desired with Respect to Teachers of Industrial Arts. 1959.
Student teachers, inservice industrial arts teachers, and public school administrators responded to a questionnaire survey. Industrial arts teachers were found to be frequently overloaded with too many classes, which were too large for the available facilities, equipment, and materials. Administrators and teachers answered the questionnaire somewhat differently, indicating a potential problem area. Specific recommendations were made for the improvement of the preparation of industrial arts teachers.

McElheny, John Richard. Industrial Education in Puerto Rico: An Evaluation of the Program in "Operation Bootstrap" from 1948 to 1958. 1960.
The development of the industrial education program in Puerto Rico was studied by means of interviews, discussions, and visits to schools. Industrial education was considered to have performed a fundamental role in the economic development and industrialization of the island. Recommendations were

made for the establishment of model industrial arts laboratories, increased teacher education activities, follow-up studies, and long-range planning.

Mehallis, George. Industrial Arts Teacher Perception of the Merit Award Program for Youth. 1963.
The industrial arts merit award program had been in operation six years at the time of this study. During that time, 700 students had received awards as outstanding industrial arts students, based on the criteria of craftsmanship, citizenship, and leadership. The teachers whose opinions were studied indicated that the program contributed, though unequally, toward the values postulated for it. Values to the school, the industrial arts program, and the teacher were noted in addition to the values to the student.

Nichols, Dwight Wilson. Resource Units in Industrial Arts Teacher Education: With Special Reference to the Development and Use of a Graphic Arts Unit on Book Publishing for Junior High Schools. 1955.
A resource unit on book publishing was developed and placed within the perspective of a total program to exemplify curriculum procedures in industrial arts teacher education. Specific recommendations were made in the areas of professional viewpoint, curriculum research, industrial participation, curriculum development, teacher education, administration, the literature, and motivation.

Olson, Delmar Walter. Technology and Industrial Arts: A Derivation of Subject Matter from Technology, with Implications for the Industrial Arts Program. 1957.
The study sought to identify a body of subject matter for industrial arts which would be reflective of the technology. Eight categories of industry were identified, and more detailed analysis yielded a list of curricular components. Representative applications of the subject matter in the various levels of industrial arts programs were outlined and illustrated, and specific implications for redirection of the industrial arts program were explored.

Olson, Fred Alfred. Industrial Arts in the Public Secondary Schools of the State of Washington. 1962.
A questionnaire was mailed to each industrial arts teacher in the State of Washington. The data were compiled on these categories: personal and professional data; non-industrial activities; philosophy of industrial arts; methodology; instructional qualifications; curriculum, enrollments, and facilities. Implications for teacher education were included in the summary.

Olson, Jerry Carl. The Guidance Function of Industrial Arts in Teacher Education. 1964.
Guidance concepts for industrial arts and industrial arts teacher education were identified. A normative survey and status survey indicated that industrial arts majors and department chairmen held different opinions on the effectiveness of student personnel services. Specific recommendations

were made for improving guidance and student personnel functions in industrial arts teacher education.

Otterson, Peder Adolph. An Evaluation of the Aerospace Technology Program at Kent State University. 1968.
A curriculum survey instrument was sent to technical, administrative, and engineering personnel of 100 aerospace industries, and to 112 graduates of the Kent State University Aerospace Technology program. Respondents noted the curricular elements for their degree of importance to an aerospace technology course of study. The ratings were used to analyze the course requirements of the Kent program. A second instrument was sent only to the graduates. This was a rating form of other program elements such as: adequacy of space, equipment, staff, and administrative support.

Paulin, Henry Sylvester. Ceramic Manufacturing Industry: Implications for Industrial Arts Curriculum Development. 1964.
The nature of industry and the history of the ceramic industry were examined. A questionnaire of 302 items concerning the elements of industry was submitted to the ceramic industries in New York State. The returns were analyzed and discussed in terms of research and product development, manufacturing operations, distribution, finance and control, business procedures, and internal and external relations. The functions and organization of the ceramic industry were summarized, and implications for education were presented.

Payne, William Vincent. A Proposed Program for the Development and Use of Instructional Media in Industrial Teacher Education at Tuskegee Institute. 1965.
Personal visits to teacher education institutions and a questionnaire to a national sample of industrial teacher education programs were the sources of data for the study. In most instances, the instructor had the responsibility for selecting, obtaining, and/or developing audio-visual materials for his courses. The most commonly used media, in order of frequency of use, were: 16mm motion pictures, overhead transparencies, and programmed instruction. Criteria were developed for the use of instructional media in an industrial education program.

Ressler, Ralph. Recruitment of Industrial Arts Teachers in the State of Ohio. 1966.
Industrial arts majors in teacher education programs, industrial arts teachers, and effective industrial arts teacher-recruiters were surveyed to obtain the data for this study. Specific precollege and college experiences of industrial arts majors were studied; 90 percent of the students had some contact with a teacher education institution prior to enrollment. The effectiveness of the industrial arts teacher as a recruiter was studied. Most effective recruiters were older, better qualified, and more active professionally than the typical teacher. A cooperative, state-wide recruitment program was proposed.

Roberts, Norman Norris. Industrial Arts Education in Kentucky. 1967.
Data were collected in seven major areas: 1) economic trends, 2) cultural nature of Kentucky, 3) teacher implementation of the technology, 4) nature of industrial arts education, 5) teacher education trends in the state, 6) certification and supply and demand, and 7) an inventory of graduates at Morehead State University. Findings of the study resulted in a list of 16 recommendations for improvement and/or development.

Rosser, Arthur James. An Exploratory Study of Using a Computer in Curriculum Development. 1968.
This developmental study was conducted to determine the feasibility of using a computer to assist the curriculum maker during the curriculum development process. A sample computer program was developed and presented in detail through seven applications to the curriculum development process. The elements of a structured body of knowledge of industrial technology were used in the sample computer programs. The computer assisted in the areas of formulating objectives, providing curriculum content and experience combinations, and providing curriculum continuity checklists. The study showed computers were feasible, based on the following seven criteria: 1) time, 2) cost, 3) equipment, 4) creativity, 5) decision-making, 6) inclusiveness, and 7) limitations.

Sorensen, Ronald Lee. Electrical Manufacturing Industry: A Resource Study with Implications for Industrial Arts Curriculum Development. 1964.
A proportional stratified sample of electrical machinery manufacturers was surveyed to identify the parts of tasks composing broad activity areas which were performed in the industry. Those sub-functions classified as important were compared with the topics in state industrial arts curriculum guides. The activities in industrial arts were concentrated upon the sub-functions in research and development; little evidence indicated adequate treatment of important topics in marketing, production, finance and control, and personnel administration. Clearer identification of primary objectives of industrial arts was considered to be a major need.

Sredl, Henry John. A History of Industrial Arts from 1920 to 1964. 1964.
Periodicals, texts, and publications of professional associations were reviewed to: 1) identify influential individuals, 2) identify major trends and movements in industrial arts, and 3) examine the work of professional organizations in industrial arts. Developments were reviewed for each of the decades under study. Two philosophical positions were identified; one which emphasized the pre-vocational values of industrial arts; the other which stressed the place of industrial arts in the contemporary technological society.

Stephenson, Leslie Earle. Superior Practices in the Administration of Industrial Arts Teacher Education. A Study of the Attitudes of Leaders Toward Derived Standards with Reference to the

Projection of an Administrative Program for California. 1958. The practices of internal administration in industrial arts teacher education departments were studied within the frame of reference of a modern point of view in the administration of higher education. A group of 10 pertinent findings and conclusions of the study were listed as guides for the development of programs of administration.

Thiel, Donald William. Industrial Arts in Occupational Therapy. 1959. The curriculum of 27 institutions approved to offer occupational therapy were studied to determine the role of industrial arts education in the programs. A questionnaire was sent to 12 persons who had graduated from each of the schools during the 1952-1957 period, for a total sample of 324. This part of the study was concerned with the types of industrial arts activities acquired in the college programs and used by the practitioner in occupational therapy. Data gathered in the study provided the bases for a series of 10 recommendations for college industrial arts courses for occupational therapy students.

Thomas, Alvin Ignace. Industrial Education in the Land-Grant Colleges and Universities: A Study to Establish a Basis for Projecting Industrial Education in the Years Ahead. 1957. The land-grant college movement was traced, with emphasis upon its involvement with industrial education. Existing land-grant institutions were studied, no industrial education offerings were found in 25 percent of them. The conclusions indicated the need for leadership to overcome existing obstacles to the development of adequate industrial education programs in the land-grant colleges.

Thrower, Robert Granville, The Status and Adequacy of Industrial Arts Programs in the Public Secondary Schools of North Carolina. 1961. A set of evaluative criteria was developed and validated by a jury of industrial arts leaders. A questionnaire was submitted to the 254 industrial arts teachers in the state, requesting information about their programs, facilities, and professional qualifications, Recommendations were made for the improvement of the secondary school industrial arts programs, for changing activities in the State Department of Education, and for the re-orientation of teacher education programs.

Towers, Edward Roy. Industrial Arts Teacher Education: An Evaluation and Projection of the Undergraduate Program of The Ohio State University. 1956. Ten guidelines for future development of the program of industrial arts teacher education were formulated, based upon these sources of data: subject matter resources, the professional heritage at the institution, the philosophy of the staff, the professional situation in the state, principles of teacher education, and recommendations of a panel of 10 experts. Emphasis was placed upon the critical need for a professional program to reflect the expanding technology.

Wooden, Ralph Lee. Industrial Arts in the Public Secondary School Programs for Negroes in North Carolina. 1956.
The educational needs of Negroes in North Carolina were studied. The 36 existing industrial arts programs for Negroes in North Carolina were found to be inadequate in terms of their physical settings and the curriculums which were available. The teachers were considered to be competent, and were using appropriate organizational techniques and teaching methods to work toward favorable objectives. Ten specific recommendations were made for the development of appropriate industrial arts programs for Negro youth.

Young, Darius Robert. The Development of a Construction Industry Interest Inventory. 1968.
An interest inventory was developed with scales for construction management, construction production, construction personnel, and construction industry technology. After pilot testing, the interest inventory was administered to 892 junior high school students in three geographical areas. A reliability coefficient of .91 was obtained, and all items were significantly correlated with the scales for which they were written.

THE PENNSYLVANIA STATE UNIVERSITY

Benson, M. James. An Investigation in the Use of Programmed Operation Sheets as a Supplement to the Group Demonstration in Teaching Manipulative Operations. 1967.
Seventh grade students observed a group demonstration of a manipulative operation, then used a standard operation sheet, a programmed instruction sheet, or an illustrated programmed instruction sheet as a supplement to the demonstration. The two programmed operation sheets were more effective than the conventional operation sheets in terms of technical knowledge acquisition and the need for assistance in performing the job. Time required for job performance and quality of the completed job were not significantly different across treatments.

Byrom, John Marvin. The Development of a Scale of Photographs for the Appraisal of Learning Influences in Industrial Arts Shops. 1957.
Evaluative criteria were developed from existing information and refined by leaders in the profession and by experimentation. Twenty instructional-influence factors were identified, and photographs were taken to illustrate each of the factors. Judges classified the conditions depicted in the photographs on a four-position scale. On the basis of the validity and reliability data obtained, it was concluded that photographs could accurately depict the quality of certain learning influences in industrial arts shops.

Campbell, Robert Asa. Student Attitude Toward Mandatory Industrial Arts Compared with Selected Variables in the Teaching Situation. 1961.

An instrument was constructed to assess student attitude toward industrial arts. It was then administered to 582 junior high school industrial arts students. Seven variables were used in the evaluation of the school's program and facilities, the student's experience, and the teacher's philosophy, methodology, professional rating, and perception of the administration. None of the correlations between the seven selected variables and student attitude toward industrial arts attained statistical significance.

Haigwood, Thomas J. A Study of Desegregation Problems That May Affect the Instructional Program of Junior High School Industrial Arts in North Carolina. 1959.
Three questionnaires were used in collecting data from junior high school industrial arts teachers in North Carolina, Delaware, Kentucky, Maryland, Missouri, Oklahoma, West Virginia, and the District of Columbia. Problem areas in segregated and desegregated schools were identified and compared. Specific recommendations were made for coping with instructional problems in desegregated classes.

Hanks, William S. Comparison of Two Methods for Encouraging Ideational Fluency in Industrial Arts Design. 1966.
An industrial arts design course for college freshmen was taught by two methods: 1) minimal restriction, where students had considerable freedom in the selection of design problems to be solved; and 2) maximal restriction, where students were assigned specific design problems. Students who were minimally restricted produced significantly more creative ideas on the posttest measure of creative ability than were produced by students who had worked under the maximally restricted treatment condition.

Harney, Leon T. The Influence of a Problem-Solving Method of Teaching on Creativity and Design Judgment in Industrial Arts. 1967.
College courses were modified to provide freedom in design decisions and to encourage creativity and design judgment. Students who completed modified courses in wood technology and metal technology attained higher creativity test scores than their peers in conventional courses; differences between groups in modified and conventional crafts courses were not significant on the creativity measure. Subjects in the modified woods course attained higher course achievement than those in the conventional course. Achievement differences between subjects in conventional and modified courses in crafts and metal technology were not significant.

Hawlk, Robert Henry. A Comparative Study of Estimated Achievement by Industrial Arts Students and Students of Cooperative Work Experience Selected from the Public Secondary Schools of Pennsylvania, Ohio, and Michigan. 1960.
Nine objectives of industrial arts served as criteria for comparing estimates of the achievement of industrial arts students and cooperative education students in three states. Students and teachers completed questionnaires to provide data. Cooperative work experience students achieved a higher

estimated level of achievement of six of the objectives, industrial arts students achieved a higher estimated level of achievement of one objective, and the two groups were equal on one objective.

Ingram, Franklyn Charles. The Effect of Elementary School Industrial Arts on Pupils' Social Studies Achievement. 1966.
Fourth, fifth, and sixth grade classes studied two social studies units, one taught by the usual methods, the other incorporating elementary school industrial arts activities. There were no significant differences between the groups in terms of achievement measures on the social studies units, improvement of silent reading comprehension, or improvement in work study skills. However, students favored the units including industrial arts activities.

Koble, Ronald Lamar. A Comparison of Individual-Oriented and Group-Oriented Learning Experiences in Industrial Arts. 1963.
Seventh grade students in a graphic arts course were provided two types of learning experiences: 1) group-oriented, and 2) individual-oriented. There were no significant differences between the two groups in terms of the learning of content information or in the degree of perceptual motor skill development. Significant differences were found in the frequency and types of interactions within the groups. The homogeneity of the group-oriented classes was also significantly affected during the study.

LeMaster, Lelan Kenneth. Filmed Demonstrations with Manual Class Demonstrations versus Conventional Demonstrations in Introductory Woodwork. 1961.
Three teachers each taught two intact groups of junior high school students during a six-week course in introductory woodwork. One group viewed eight filmed demonstrations before observing the manipulative demonstrations in class; the other group did not use the films. The filmed demonstrations were found to be effective in terms of student achievement of manipulative skills and mastery of technical knowledge. In addition, the films reduced the number of manual demonstrations which individuals and small groups required from the teacher.

Miller, Dudley Bryant. A Critical Analysis of the Vocational Guidance Practices Employed by Industrial Arts Teachers in Selected Junior High Schools in the United States. 1965.
Survey forms were provided by 469 junior high school industrial arts teachers from a national sample. Most of the respondents had some professional preparation in guidance, usually at the graduate level. A large majority of the teachers considered vocational guidance to be an objective of industrial arts and considered themselves to be the best qualified faculty members to provide guidance, yet few actually provided guidance functions in their classrooms.

Thieme, Eberhard. Pupil Achievement and Retention in Selected Areas of Grade Five Using Elementary Industrial Arts

Activities Integrated with Classroom Units of Work. 1965.
Fifth grade students learned their classroom units under one of two conditions: 1) traditional methods, and 2) three-dimensional industrial arts activities integrated with the unit. The two groups did not differ significantly on variables related to work study skills, map reading, and map knowledge, when achievement was assessed after treatment and after the summer vacation. Classroom teachers were less favorable than elementary industrial arts teachers in their evaluation of classroom construction activities.

Weber, Earl M. A Comparative Study of Industrial Technology Programs in American Colleges and Universities, with Industrial Arts Teacher Education and Technical Institute Programs. 1961.
Four-year industrial technology programs were compared with industrial arts teacher education programs in terms of purposes, staff qualifications, curriculum requirements, and student enrollments. Areas of similarities between the three programs were noted, and significant differences between the program types were discussed.

PURDUE UNIVERSITY

Bledsoe, Harry James. A Comparison of the Educational Development of Diversified Cooperative Education Students and Non-Diversified Cooperative Education Students in Selected Indiana High Schools. 1968.
Senior students who had been enrolled in Diversified Cooperative Education were matched with students who had not enrolled in DCE, according to sex, age, school, and achievement test scores prior to enrollment in DCE. Achievement was assessed again at the end of the senior year, using the *Iowa Tests of Educational Development*. The general educational development of the two groups was not significantly different in terms of posttest scores on the *ITED*. It was concluded that DCE programs afforded participants an opportunity for general educational development comparable to that offered non-DCE students.

Erickson, Richard Charles. A Comparison of the Visual-Haptic Aptitudes as They Relate to Student-Teacher Interaction in the Teaching-Learning Process Associated with Beginning Mechanical Drawing. 1966.
Teachers and students in an eighth grade mechanical drawing course were measured for visual-haptic aptitude. The achievement of the students, as graded by teachers, and as assessed independently on an objective test, was directly related to the visual-haptic orientation of the student. On the criterion test, student performance was inversely related to visual-haptic orientation of the teacher; students of the haptically oriented teachers performed significantly better.

Keim, Lawrence. A Study of Psychometric Profile Patterns of Selected Associate Degree Technology Majors. 1966.

The research sought to identify differences between and among the profile patterns of beginning and transfer students in five technology curriculum groups: aviation maintenance, architectural engineering, electrical engineering, and industrial illustration technologies. The *Kuder Preference Record--Form CH* and the *Allport Vernon Study of Values* appeared to be useful in counseling students among the technologies studied; the *Guilford-Zimmerman Temperament Survey* and the *Wonderlic Personnel Test* were not. Age was not an important factor in counseling students in the technologies.

Middleton, William Howard. The Relationship between Perceptual-Motor Development and Drafting Achievement in the Junior High School. 1962.
A sample of 100 eighth grade beginning drafting students was tested on 27 perceptual-motor tasks. Drafting achievement was measured by a series of 15 drafting exercises. Seventeen of the 27 perceptual-motor tasks were closely correlated with drafting achievement. The relationship between perceptual-motor development and drafting achievement was significant, though not all perceptual-motor tasks were effective predictors of achievement in drafting.

Poucher, Kenneth E. An Exploratory Study: Achievement in Power Mechanics as Related to Grouping of Students and Other Factors. 1968.
The relationship between performance on a Power Mechanics Achievement Test and laboratory grouping techniques, Scholastic Aptitude Test scores, personality variables, and biographic variables was explored. SAT verbal and mathematics scores, occupation and education of mother, length of employment, and EPPS deference and intraception component scores on the Power Mechanics Achievement Test. There was little educational advantage of grouping students into adjacent and non-adjacent work pairs on the basis of pretest scores.

Sedgwick, Lorry King. The Effectiveness of Graphics as a Basic Communication Medium. 1965.
An experimental graphic communication course was developed, using isometric drawing, orthographic projection, dimensioning, graphs, and bar, compound bar, pie, and schematic diagrams as content, and limiting the student to pencil and plain paper for his work. The experimental course was compared with a conventional eighth-grade mechanical drawing course during a five-week period. The course in graphic communication was successfully learned by students without materially jeopardizing learning of the more conventional subject matter.

Wagner, Edgar Stephen. An Analysis of Purposes Accepted by, Teaching Techniques used by, and Resources Available to Industrial Arts Instructors in Indiana High Schools Employing One Industrial Arts Instructor. 1960.
A total of 147 industrial arts teachers responded to a questionnaire indicating the purposes of their programs, the teaching techniques they used, and the resources available to

them. These responses were compared with recommendations of a jury of specialists; a high degree of correspondence was apparent in terms of purposes and teaching techniques. However, the physical facilities reported by the teachers were inadequate in terms of the opinions of the specialists.

Windle, Jim L. The Employment Selection Process: A Comparative Analysis of Two Methods for Reporting Academic Performance Data. 1968.
An alternative method was developed for reporting academic performance data on the College Interview Form, to provide additional data beyond the grade point averages and class ranks available on the standard form. The two methods were used with engineering and non-engineering majors interviewing 79 employers. Provision of more extensive performance data was helpful for engineering majors in the lower 50 percent of the senior class; students in the upper 50 percent of their class were not aided by the additional data when the criteria were further considered beyond the interview and visit offers.

TEXAS A & M UNIVERSITY

Amthor, William Dale. An Experimental Comparison of Three Methods for Presenting Selected Concepts of Descriptive Geometry. 1967.
College students in two institutions were taught six principles of descriptive geometry by three methods: lecture/demonstration, silent filmstrips, and sound filmstrip. A rotational design permitted each subject to be exposed to each of the three methods. No significant differences in initial learning were obtained among the three methods, or between the two institutions; however, the principles were not equally difficult. Students preferred the lecture/demonstration method, but suggested incorporating the filmstrips into the presentations.

Anderson, Kermit Peder. An Experiment to Determine the Effectiveness of Caricature Booklets in Supplementing Conventional Machine Woodworking Safety Instruction. 1967.
Instructional booklets were developed to present safety information on six woodworking machines in caricature format. Conventional safety instruction was presented in one method, the caricature booklets were used to supplement conventional instruction in the second method. Each group of subjects received three units of instruction by each of the methods. The method using supplementary booklets resulted in improved initial learning and retention on three of the six units. The nine teachers varied in effectiveness, and teacher effectiveness interacted with treatments for several of the units.

Baker, Glenn E. A Comparison of the Problem-Solving Method of Project Construction and Conventional Methods in Teaching the Laboratory of a College Course in Beginning Electricity. 1966.

Subjects were matched on the basis of pretest scores, and were assigned to one of the treatments: 1) constructing individual projects, using a problem-solving approach, with laboratory attendance not required, and 2) completing required laboratory circuit board excercises and teacher-planned projects. No statistically significant differences were obtained in terms of: 1) learning of factual knowledge, 2) acquisition of manipulative skills, and 3) attitudes toward the course. Students preferred activities which resulted in useful articles.

Ballard, John R. A Study to Determine the Effectiveness of Two Methods of Instruction on Achievement and Retention in Industrial Arts. 1966.
Basic information on wood joinery was presented to beginning woodworking students at the college level by two methods: 1) a programmed text, and 2) a lecture-discussion supplemented by 2 X 2 inch colored slides. Data from the test scores of the 296 subjects indicated that the programmed instruction method was more effective than the lecture-discussion method, despite the fact that only 85 percent of the programmed lessons were completed.

Bertrand, Clint A. An Experimental Development of Programmed Instructional Material for the Vocational Education Department of the Texas Department of Corrections. 1964.
Inmates were trained in programming, and wrote linear and branching programs in electricity, barbering, and guidance. No significant differences in effectiveness were obtained between linear and branching formats; between overt and covert responses; between programmed textbook and machine presentation; or between study in cells or in the classroom. However, presentation by machine was more effective for study in the cell; the programmed book was more effective in the classroom.

Blum, Robert. Development and Standardization of an Achievement Test for Placing College Students in General Drafting Courses. 1965.
The researcher developed a 140-item, multiple-choice examination to assess achievement in college-level drafting courses, and established norms based upon the performance of 3657 subjects in 71 institutions in 31 states. Content validity and concurrent validity were considered satisfactory; reliability coefficients ranged from .84 to .95. The examination was considered satisfactory for use as an advanced placement test.

Boone, James L., Jr. The Relationship Between Selected High School Subjects and Achievement by Engineering Students. 1966.
The researcher compared the academic achievement of 411 engineering freshmen with the number of high school credits in various subjects. The number of high school credits in foreign languages was significantly related to college achievement; however, no such relationship existed for the number of high school units in industrial arts,

mathematics, science, and social science. High school grade average and SAT total score were significantly correlated with college academic achievement; high school rank, father's occupation and education were not, when other variables were held constant.

Brooks, Weston T. An Experimental Analysis of the Effectiveness of Overhead Transparencies on Learning and Retention (in Selected Units) in Beginning Woodworking. 1964.
Supplementing conventional instruction with overhead transparencies resulted in significantly higher achievement in units of design, plan of procedure, bill of materials, joints, and measuring. In addition, the use of supplementary transparencies reduced achievement differences between student ability levels.

Chambliss, Kinneth M. Staff Needs for Planning Inservice Education Programs in Adult Trade-Technical Institutes. 1966.
The researcher conducted a normative survey of trade-technical instructors, related instruction teachers, and trade-technical administrators to identify their needs for professional assistance. Needs common to all three groups and to each group were identified and listed; specific recommendations were given for the development of a program of inservice education in North Carolina.

Cozzens, Charles Richard. A Comparison of Two Techniques of Teaching Engineering Descriptive Geometry. 1965.
Preparatory assignments in descriptive geometry were completed by 356 college students, using two means of grading: self-scoring by comparison with a rating scale; and conventional instructor scoring. The overall analysis indicated that self-scoring was preferred by the students, required less time, was satisfactorily accurate, and led to improved achievement on later criterion measures.

Craft, Clyde O'Brien. Creativity in Engineering Graphics: An Experimental Comparison of Two Types of Graphics Problems. 1967.
Three teachers taught one section of engineering graphics by each of two methods: 1) traditional drafting problems and open-end design problems, including a self-instruction booklet on creativity and design, and 2) the same traditional problems plus additional problems of this type to balance student assignments. Students receiving the design problems demonstrated significantly greater gains in originality and ideational fluency scores on the AC Test of Creative Ability. The two groups were not significantly different in gains in subject matter knowledge and skills.

Crowder, Gene A. Visual Slides and Assembly Models Compared with Conventional Methods in Teaching Industrial Arts. 1968.
Slides and assembly models covering selected units in general shop were used to present information to public secondary school students. An equated group received conventional instruction over the same units. On the basis of tests of initial learning and retention, the method utilizing slides

and models was more effective than the conventional method. The direction of the differences was consistent across intelligence levels.

Dennis, Ervin Allen. An Experimental Analysis of Industrial Arts Concerning the Accomplishment of Selected Objectives. 1966. The progress of 803 high school boys toward three industrial arts objectives was assessed by means of a noncognitive measuring instrument. Industrial arts experiences appeared to accomplish the objective to "develop in each student an active interest in industrial life and problems of production and exchange." However, industrial arts did not make significant positive changes in "desirable attitudes and practices with respect to health and safety" or in "the habit of an orderly and efficient performance of any task."

Earle, James H. An Experimental Comparison of Three Self-Instruction Formats for Descriptive Geometry. 1964. Six descriptive geometry principles were presented to 503 students by four methods: conventional lecture; textbook; step method (a series of sequential steps in problem solution); and step method in color. The most effective method was the step method in color, followed by the step method, the lecture method, and the textbook method, respectively. The step methods were recommended as possible formats for programmed instruction for descriptive geometry.

Entorf, John Frederick. An Experiment to Determine the Effectiveness of Video-Taped, Closed-Circuit Television in Teaching Selected Woodworking Units. 1967. Four units of technical information in woodworking were recorded on video-tape from art cards, key cards, slides, motion pictures, and samples of materials. The 153 subjects received instruction for two units from the video-tapes and two units from a conventional lecture in which all the visual aids used to produce the video-tape were available. The video-tape method resulted in higher mean scores on tests of initial learning and retention. Some interaction between units and methods was detected. Students preferred the lecture method, and thought it covered the material more thoroughly than the video-tape.

Envick, Donald Dee. A Comparison of Equipment, Materials and Processes of the Plastics Industry with That of Selected Secondary Schools. 1968. Data were obtained from 79 secondary schools with plastics courses and from 127 industries involved in at least two types of plastics processing. Significant differences were found between school and industrial opinions on the utilization of plastics processes, materials, and equipment, and on which of these items should be included in industrial arts plastics programs. Specific recommendations were made for the selection of plastics equipment, processes, and materials for industrial arts courses.

Falls, John E., Jr. A Comparison of Introductory Industrial Arts with Metal and Wood Manufacturing Industries. 1968.

Junior high school industrial arts teachers and personnel directors of manufacturing companies rated the importance and frequency of occurrence of curriculum components listed in state curriculum guides in woodworking and metalworking. The two groups differed in their rankings of the frequency with which the various curriculum components were found in their respective settings. The groups also differed in their opinions of the importance of the items for inclusion in an exploratory course, with the teachers selecting skill-related items more often and the industrial personnel selecting information-related items more frequently.

Fowler, Richard J. An Experimental Comparison of Two Laboratory Methods for Teaching College-Level Introductory Electricity in Industrial Education. 1965.
Subjects in the experiment received identical lectures, demonstrations, homework, and tests. Matched groups of 28 subjects each were engaged in two types of laboratory activities: 1) project method, and 2) quick-disconnect circuit method. The two methods were equally effective in teaching direct current and alternating current principles and concepts, manipulative skills, and in the levels of retention of subject matter. Students had a favorable attitude toward the course, but there was no difference between the attitudes of the groups receiving the two methods.

Humbert, John Joseph III. Selected Factors Affecting Attitudes of School Administrators and School Board Presidents Toward Industrial Arts in Small Schools. 1967.
A mail survey was sent to 200 top administrators and their school board presidents in small schools in Texas. Administrators had more favorable attitude toward industrial arts than school board presidents. Administrators and school board presidents from schools having an industrial arts program had a more favorable attitude toward industrial arts than their colleagues from schools with no industrial arts program. Age income, occupation, and years of service did not have significant effects upon attitudes toward industrial arts.

Johnston, Wallace Lamont. Factors Influencing Certain Pre-engineering Students in Selecting a Four-Year Institution for the Completion of an Engineering Degree. 1968.
Students enrolled in pre-engineering programs in junior and senior colleges were studied to identify factors influencing their selection of an institution in which they could complete an engineering degree. The selection of an institution was influenced by the student's socioeconomic background, financial considerations, and the advjce of relatives; perceived institutional image was not an important factor.

Lemons, Clifton Dale. An Investigation of Relationships between Mechanical Drawing Experience, Certain Measures of Academic Ability and Knowledge of Drawing Fundamentals to Determine Criteria for Assigning Students to Accelerated Sections of Engineering Drawing. 1965.
On the bases of multiple regression analyses, the number of semesters of high school mechanical drawing was the best criterion for placing students in accelerated college sections;

students with two or more semesters in high school could qualify. However, the accelerated sections of engineering drawing should cover all typical content areas. Several prediction formulas were developed for use in the two cooperating universities, an engineering school and a teacher education institution.

Lundy, Lyndall L. Programmed Booklets Compared with Sound Filmstrips in Teaching Automotive Electricity. 1968.
A block of four units of instruction on the automotive ignition circuit was presented to 166 beginning students of automechanics. Each student learned two of the four units of instruction by means of linear programmed booklets and two of the units by means of sound filmstrips. Tests of initial learning over the block of instruction indicated that the programmed booklets were most effective; the two methods did not differ significantly when retention was used as the criterion. When the data were examined by unit, initial learning test results favored the program for one unit, but the two methods were not significantly different for the other three units.

Magowan, Robert Evans. A Comparison of Pragmatical and Hypothetical Problems for Developing Creativity in Design. 1967.
Students in architecture and in industrial education were pretested, then provided a self-instructional booklet on creative design. Six pragmatical design problems (requiring solutions for utilitarian products) and six hypothetical problems (requiring solutions for supposed products) were administered to the sub-groups. No significant differences were obtained in the overall comparisons between the pragmatical and hypothetical approaches in terms of aesthetic awareness, quantity of ideas, or unique ideas.

Pershern, Frank R. The Effect of Industrial Arts Activities on Science Achievement and Attitudes in the Upper Elementary Grades. 1967.
Two science units, electricity and machines, were taught to intact classes in fourth, fifth, and sixth grades by two methods: traditional and experimental (supplemented by industrial arts activities). The experimental method produced significantly greater achievement in one of the two units for two of the three grades; the remaining comparisons did not attain significance. Students and teachers favored the experimental method, and thought that it enriched the elementary science program.

Ross, Raymond J. Analysis of Industrial Arts Equipment Utilization by Work Sampling. 1966.
A work sampling procedure was developed for measuring metalworking equipment utilization. One observer obtained 20,800 observation cards in three high school laboratories during the two-and-one-half months of the study. Significant differences in utilization were obtained for 14 of the 17 equipment types when the three laboratories were compared; the overall hypothesis of no difference in utilization was rejected. Concern was expressed over the high incidence of inoperative equipment, unoccupied equipment, and low class time utilization percentages.

Roy, Wendell L. A Comparative Study of Selected Objectives of Industrial Arts. 1963.

In this study, 2681 ninth grade students were tested to evaluate the degree to which industrial arts metalworking and woodworking courses accomplished three objectives: 1) interest in industry; 2) appreciation of good design, materials and workmanship and the ability to select, care for, and use industrial products wisely; and 3) shop skills and knowledge. Ninth grade metalworking and woodworking students attained significantly higher scores than ninth grade industrial arts students who had not taken metalworking or woodworking on the three criterion tests: 1) interest in the metalworking and woodworking industry; 2) appreciation and use of metal and wood products; and 3) shop skills and knowledge.

Schuler, Charles A. A Comparison of Two Laboratory Techniques for Teaching Basic Electronics in Industrial Education. 1966.

Subjects were all given the same lectures and demonstrations, but divided into two equivalent groups for different laboratory experiences. One group, using circuit boards with pre-mounted components and solderless connectors, attained higher test scores and had a more positive attitude toward the laboratory phase of the course than the group which used comparable circuits, constructed conventionally using a metal chassis. No significant differences in trouble-shooting skills or manipulative skills were attributed to the method of laboratory instruction.

Simons, Jerold Jean. Relative Understanding of Mathematical Concepts by Students Majoring in Electronics Technology. 1967.

A jury of college instructors identified the mathematical concepts from a master list of concepts from electronics textbooks, and industrial personnel indicated which concepts were needed by entry-level electronics technicians. A standardized instrument to test student understanding of the mathematical concepts was developed and administered to a national sample of graduates of two-year and four-year programs in electronics technology. Analysis of the test results indicated a need for more emphasis on the mathematical concepts considered necessary by personnel from the electronics industries.

Strandberg, C. E. A Comparison of Selected Industrial Printing Practices with Those Taught in High School Vocational Printing Classes. 1963.

Comparison of reports from national samples of 293 firms and 148 vocational schools indicated lack of a close relationship between education and industry in terms of 1) the major areas of work; 2) the degree of specialization of workers and equipment; 3) work methods, techniques, and practices; 4) the array of equipment in use; and 5) the application of time- and labor-saving devices. Specific recommendations for improving industry-education correlation were included.

Teel, Dean Allen. A Comparison of Methods Utilizing the Contract Approach in Teaching Beginning Electricity-Electronics Fundamentals to College Students. 1967.

Beginning electricity-electronics students were instructed by two methods: 1) contract, involving a written contract structured by the instructor and completed by the students; and 2) traditional, involving lecture, discussion, a textbook, laboratory exercises, and group and individual projects. Students receiving traditional instruction achieved higher scores on a test of fundamentals of electricity-electronics than those using the contract method.

Thomas, Maurice Grover. Industrial Arts Activity in the Development of Manipulative Ability. 1968.
Eleven components of manipulative ability were identified. Tests were obtained or developed for measuring 10 of the ability components. The battery of tests was administered to 160 senior high school boys who were assigned to groups on the basis of their previous experience in industrial arts woodworking or metalworking. Subjects who had completed industrial arts scored significantly higher than subjects who had no industrial arts on tests of manual dexterity and finger dexterity. Subjects with two years of industrial arts attained higher scores on tests of wrist finger speed and aiming than subjects with no industrial arts. The groups did not differ significantly on the remaining six variables.

Underhill, Charles M. The Status of and Need for Industrial Arts Instruction in Seventh-Day Adventist Secondary Schools. 1968.
The industrial arts program of 67 Seventh-Day Adventist academies were evaluated in terms of the attitudes of professional personnel toward industrial arts, the interest of junior and senior boys in industrial arts, the professional attributes of the teacher, and the adequacy of the program and facilities. No significant differences between schools were identified on the attitude and interest measures. Programs and facilities and teacher qualifications were found to differ significantly between the smaller and the larger schools.

Vasek, Richard J. A Comparative Analysis of Electronic Content in Post-High School Technical Institutes and Electronics Technology Requirements of Industry. 1967.
Electronics instructors and firms employing technicians were surveyed to determine the emphasis each group placed on 435 identified items of electronics content. There was general agreement upon the relative importance of 197 items. For the remaining 238 items, the instructors indicated more educational emphasis on the content than the industrial personnel thought necessary. A wide range of positions was identified within the occupational spectrum of electronics technology.

Vogel, Richard F. An Analysis of the Comparative Effectiveness of Common Methods Used in Teaching Electricity on the Junior High School Level. 1968.
A comprehensive examination covering junior high school electricity content was prepared and administered to 1290 students in junior high school electricity courses taught by 20 teachers. Statistically significant differences in teaching effectiveness were found between teachers, with student achievement test scores as the criterion. Teachers provided information about their teaching methods, instructional materials, and

classroom procedures used in teaching the content. The analysis of these data indicated no significant differences in effectiveness among the identified variables.

Wallace, Norman E. An Analysis and Revision of the Road Rules' and Road Signs' Parts of the Texas Operator's License Examination. 1968.
The subtests of the driver's license examination dealing with road rules and road signs were examined through an item analysis and validity comparison of completed tests. Revised tests were constructed and administered in a pilot study. The equality of the forms was improved, difficulty levels were increased, validity was improved, and reliabilities were improved for most forms.

White, Leland W. Vocational and Technical Educational Needs of the Adult and Out-of-School Youth in South Dakota. 1966.
The researcher gathered population, employment, and educational data in identifying the need for increased vocational education in South Dakota. A suggested pattern for area vocational schools was developed and presented.

WAYNE STATE UNIVERSITY

Austin, Robert T. Industrial Education Programs in Selected Foreign Countries Assisted by the United States Government, 1952-1962. 1965.
Assistance programs conducted in foreign countries by six American institutions during the 1952-1962 decade were analyzed. The need for assistance in foreign countries to improve curricula, upgrade teacher education, plan laboratory facilities, write instructional materials, and construct teaching aids was noted. Areas of conflict and misunderstanding were identified and suggestions for improvement of contracting arrangements were listed.

Baranyai, William A. Adjustment Experiences of Industrial Education Teachers of the Detroit Public Schools. 1965.
A total of 303 newly assigned industrial education teachers provided information on their personal backgrounds, professional preparation, interests, plans, value judgments, and employment experiences. Favorable adjustment responses were associated more frequently with older teachers; higher morale was associated with higher levels of formal education; vocational certification was positively related to adjustment experiences; and three or more semesters of student teaching in Detroit were associated with positive professional attitudes. Professional adjustment was related to personality factors, quality of administration, and quality of physical facilities.

Barich, Dewey Frederick. Development and Projected Role of the Detroit Institute of Technology. 1961.
The development of the Detroit Institute of Technology was traded from its inception in the Young Mens Christian Association through independent status in 1954 to the inauguration of the president in 1959. An institutional self-study completed

in 1960 provided data on purposes, organization, programs, faculty, student body, facilities and resources, and alumni achievements. A series of guiding principles was used in an interview instrument administered to the trustees and to community leaders. The analysis and synthesis of these responses provided five guidelines for future institutional development.

Benson, Willard A. Measurable and Observable Factors in the Selective Retention of Doctoral Candidates with Special Implications for Industrial Education. 1959.
Selection and retention standards used in nine universities were identified through questionnaires and interviews with personnel responsible for the industrial and/or vocational education doctoral programs. Test scores, academic records, work experience, and subjective factors were most frequently used factors in the selection of doctoral candidates. Analysis of test scores of successful and unsuccessful candidates at one institution permitted the development of a formula which provided maximum efficiency in predicting academic success on the basis of composite scores from two standardized instruments.

Bohn, Ralph C. An Evaluation of the Educational Program for Students from Foreign Countries: Emphasis Upon Orientation Procedures, Individual Problems, and Psychological Variables. 1957.
Students studying in this country were interviewed and asked to complete a series of tests and an anonymous questionnaire. Most of the students were preparing to administer industrial or general education programs in their home countries. The students demonstrated serious weakness in language ability, yet they received grades which were equal to or better than the grades of American students. Their attitudes were favorable toward the United States, despite problems with language, food, housing, and climatic conditions. Areas of program strength, as well as problems and misunderstandings, were identified and discussed.

Cochran, Leslie H. A Comparison of Selected Contemporary Industrial Education Programs. 1968.
A historical review of industrial education programs indicated that more modifications with wider implications had been made since 1960 than during any previous decade. Curriculum elements were identified and incorporated into a conceptual framework which was used in a systematic comparison of selected contemporary industrial education programs. Individuals associated with the selected programs were in general agreement on many of the items, yet the structures of the programs studied varied greatly where different positions were taken on key issues. Specific areas of agreement were noted, and observations were made to guide further efforts.

Crawford, Harold W. Organizational Patterns for Industrial Education Programs in Selected Land-Grant Colleges. 1960.
Examination of catalogs and structured interviews with administrative personnel provided data for the intensive study

of industrial education programs at the 17 land-grant institutions created by the second Morrill Act of 1890. Desegregation had influenced the organizational patterns at these institutions, and no single organizational pattern was considered to be appropriate for all institutions. The major objective of the programs was industrial teacher education, conducted in cooperation with other teacher education programs. Terminal technical programs were not in demand. Industrial education and engineering were being separated in some of the institutions studied.

Dunlap, Eugene W. Aims for Manufacturing Processes in Undergraduate Engineering Education as Evaluated by Professional Engineers in the Greater St. Louis Area. 1962.
Ten proposed aims for teaching manufacturing processes in undergraduate engineering programs were developed from a review of the literature. These aims were evaluated by professional practicing engineers and revised to reflect the opinions of the practitioners. The sample of practicing engineers was not in complete agreement on the aims for manufacturing processes, but the majority of them were in agreement that the content should be included in the undergraduate engineering curriculum.

Hagemeyer, Richard H. An Investigation of Factors Considered in the Selection of Apprentices by Manufacturing Companies in Michigan. 1961.
A stratified random sample of manufacturing companies with apprenticeship programs was studied to identify the factors considered important in the selection of persons to enter the apprenticeship programs. Several areas of differences between large and small firms were noted. High school graduation was a general prerequisite. A good work experience record, good recommendations from previous employers and from schools, and hobbies related to mechanical things were factors in initial selection. A probationary period typically served as the final phase of selection.

Helton, H. L. Evaluation in Industrial Arts Teacher Education. 1958.
Chairmen of industrial arts teacher education departments rated the importance of characteristics of industrial arts teacher education programs. A tentative evaluation instrument was prepared and submitted to interested accrediting agencies for review. Their suggestions guided the further refinement of the instrument. The instrument and a supplementary guide for industrial arts teacher education were submitted to the National Council for Accreditation of Teacher Education; the materials were also an integral part of the 1958 yearbook of the American Council on Industrial Arts Teacher Education.

Johnson, Harry L. Curriculum Development in Vocational-Technical Education: With Special Reference to the Norfolk Division of Virginia State College. 1956.
Developments in vocational-technical education were reviewed and the rise of technical occupations was noted. The Norfolk-Portsmouth area was surveyed to estimate the total numbers of technicians employed in 11 technical areas and the annual

replacements needed in each area. It was concluded that the local needs warranted programs to prepare personnel for several technical fields, and the Norfolk Division of Virginia State College was considered to be a logical center for such programs.

Kavieff, Melvin Charles. Requirements for Selected Occupations in the Automotive Industry with Implications for Technical Education at the Post-Secondary Level. 1961.
A review of the literature found no well delimited definition of the technician's role, despite the rapid growth in the occupational classification. The technical institute was identified as the institution most adaptable to changing needs for technicians. A definite need was identified for post-secondary educational programs to prepare industrial technicians for the automotive industry in the Detroit area.

King, Thomas Gordon. Fundamental Procedures of Research for Industrial Education. 1958.
Instructional materials on research procedures used in 36 institutions were analyzed to identify units of instruction and texts to be recommended. Fifteen units of instruction were incorporated in a manuscript for a syllabus on research procedures for industrial education. A study of 78 doctoral dissertations revealed seven types of research procedures: normative surveys, historical, experimental, documental, philosophical, legal, and case studies. The studies investigated problems dealing with history, instruction, teacher education and student teaching, vocational programs, administration, guidance, and supervision.

Lappin, Alvin R. An Evaluation of Procedures for Introducing New Materials, Tools and Processes in Industrial Arts Teacher Education. 1958.
Industrial arts teacher education departments provided information on procedures for introducing new materials, tools, and processes in their programs, and high school teachers indicated the resources they had found helpful in developing competency to teach with new materials, tools, and processes. In many cases, progressive high school teachers were found to precede the teacher education programs in introducing new items. Sources outside of industrial arts teacher education provided most of the means for developing teacher competencies in newer areas.

Laws, Norman G. Mathematical Needs of Technicians in Selected Michigan Industries. 1966.
Management personnel were interviewed in 71 industries employing technicians. Mathematics utilization data were obtained from senior technicians. A common core of mathematical skills was identified as needed for all technologies. Suggestions were included for organizing and teaching a technical mathematics course.

Minelli, Ernest L. The Role of the Departmental Chairman in Industrial Teacher Education: A Survey of the Requirements of the Job and an Analysis and Evaluation of the Activities of the Chairman. 1958.
A sample of 123 chairmen of industrial teacher education

departments provided information on their preparation and experiences, the desirable preparation for their positions, their working conditions, and their activities on the job. The chairmen estimated that they spent an average of 52 hours per week at their jobs, with general administrative duties and their personal teaching assignments being the two most important activity categories. None of the eight other activity areas required more than four hours of their time in an average week.

Moeller, Carl A. **Aims for Undergraduate Industrial Teacher Education: A Study of Projected Aims and Supporting Principles as Evaluated by Selected Representatives of Labor and Industry. 1961.**
A tentative list of aims and principles was identified and developed into an evaluative instrument which served as the base for interviews with 38 men from industry and labor. The study indicated a need for well-defined competency levels for teachers, suggested that college preparation should be supplemented with industrial experience, noted that industrial arts teachers should develop depth competence in one or two areas, and emphasized the need for teachers to understand the social aspects of industry.

Powell, Paul E. **Administration of Departments of Industrial Teacher Education: Budget and Accounting Systems. 1955.**
Budget and accounting systems in use in departments of industrial teacher education were identified from questionnaires completed by department chairmen. Criteria were developed for determining the effectiveness of budget and accounting systems, and a basic set of forms was developed for use in the individual departments studied.

Sargent, William T. **Student Teaching in Off-Campus Programs in Industrial Arts: A Survey Directed Toward Identifying Qualifications and Responsibilities of Industrial Arts Supervisors and Cooperating Teachers and Toward Evaluating Industrial Arts Off-Campus Student Teaching Activities. 1956.**
A review of the qualifications and responsibilities of 67 individuals responsible for supervising industrial arts student teachers indicated that most of them were administrators specializing in industrial arts, with teaching responsibilities at both the undergraduate and graduate levels. Their responsibilities for student teaching covered the entire spectrum of planning, scheduling, and supervising the student teaching experience. Cooperating teachers were consulted to identify activities which promoted professional growth of the student teachers; these were incorporated into a series of recommendations for improving off-campus programs of student teaching in industrial arts.

Schoeppler, Jacob. **A Case Study of Production Foremen's Activities and Problems. 1958.**
Foremen in a major automobile manufacturing plant were observed and interviewed to determine their activities and related problems. Short observations and interviews were repeated frequently over a three-month period. Management personnel were also interviewed to determine their perception of

foremen's problems. Foremen's activities, their problems, and the degree to which the perceptions of these problems were shared by foremen and their superiors were discussed.

Sechrest, Charles H. The Supervision of Industrial Arts: Effective Practices and Selected Major Problems. 1953.
Returned checklists from 247 supervisors of industrial arts identified six major problem areas: upgrading inservice teachers, maintaining morale and professional attitudes, developing an industrial arts program of educational significance, improving the instructional program, preparing curriculum materials, and establishing techniques for acquainting others with industrial arts. Effective practices used by industrial arts supervisors were reported.

Sherman, Douglas Roland. The Emerging Role of Vocational-Terminal Education in the Public Community Colleges of Michigan. 1956.
The literature was reviewed to identify broad generalizations on the role of vocational-terminal education in the community college. The vocational-terminal programs in public community colleges in Michigan were assessed by a status study, a review by outside personnel, a content analysis, and responses to a check list. Specific recommendations were made on the basis of the findings of the study.

Smith, J. Asbury. Implications of Television for Industrial Arts. 1957.
Individuals who had presented industrial arts content on television were identified and asked to assist in the evaluation of practices in the preparation and presentation of television programs. Responses to an opinion inventory provided guidance for the development of a brochure describing production practices and techniques for telecasting industrial arts activities.

Soule, David H. The Role of the Director of Vocational Education in the Local School Districts of Michigan. 1966.
The responses of able, experienced directors of vocational education and of relatively inexperienced directors were obtained on an instrument developed to provide information on several relevant variables dealing with vocational education. Interviews were conducted to assess the reactions of the subjects to crucial situations. Significant differences were obtained between the responses of able, experienced directors and the responses of the inexperienced directors.

Stegman, George K. Proposed Aims for Graphics in Engineering as They Could Contribute to Collegiate Engineering Education. 1962.
Deans of engineering, heads of engineering departments, and industrial respondents rated the relative importance of goals of engineering graphics courses in engineering education. After the analysis of the data, a revised structure of proposed aims for graphics in engineering was developed, with four major aims and eight contributory aims.

Stern, Jacob. The Functions of Goods Producing Industrial Establishments: A Validation of Selected Elements

in a Definition of Industry as a Framework for Curriculum in Industrial Education. 1964.
A basic framework of four functions was proposed to classify activities in the productive processes utilized in goods-producing establishments. The proposed framework was submitted to professional management consultants and manufacturing management personnel for their suggestions; it was also compared with the content of textbooks on industrial organization. The pattern of functions was modified to correspond with information obtained in the study, and the reformulated functions were offered as a basis for curriculum construction in industrial education.

Sutton, Fred Crawford. Factors Affecting the Retention of Part-Time Business and Industrial Teachers in Community Colleges--Henry Ford Community College, A Case Study. 1962.
Instructors who had taught at least four semesters provided data for comparison with responses from instructors who had terminated their employment after one or two semesters. In addition to a survey inventory, interviews were conducted to obtain verbal comments. Significant differences between the high-retention instructors and the low retention instructors were obtained on several factors.

Swaengsudi, Thanoo. A Study of the Educational Programs of Thai Students in the United States Under the Sponsorship of the International Cooperation Administration During the 1958-59 Academic Year. 1960.
A survey instrument was completed by 190 Thai students at four universities. Most were satisfied with their programs and felt that their educational experiences could be applied, though with some difficulty, to situations in Thailand. Inadequate competence in English had been the source of most of the major problems encountered by the students in the United States.

Walls, W. Dale. Problems and Preparation: Anticipation Versus Experience--First-Year Industrial Arts Teachers in Michigan.. 1964.
A statewide sample was queried twice: once as seniors in industrial arts teacher education, and one year later as first-year industrial arts teachers. They were asked to identify problems which they anticipated and/or experienced, the seriousness of the problems, and the degree to which their undergraduate programs prepared them to cope with the problems. The two assessments of preparation for handling problems and the identifications of problems were in essential agreement. However, first-year teachers considered the problems to be more serious than graduating seniors had anticipated that they would be.

Wolansky, William D. An Identification of Fluid Power Instructional Goals and Content for Industrial Education Teacher Preparation. 1968.
Appropriate goals were identified for fluid power instruction and reviewed with a jury. A framework for technical content was proposed and subjected to review by 24 specialists.

Suggested outlines were then developed for fluid power courses in industrial teacher education; these were also evaluated by consultants. The procedures used in the study were considered suitable for use in infusing other evolving technologies into industrial teacher education.

Ziel, Henry R. An Investigation of Information Dissemination Practices at Two Disparate Companies. 1962.
Information dissemination practices were examined in a manufacturing organization and in a research organization. The chief executive, all supervisors, and a random sample of nonsupervisory employees were surveyed and interviewed. Patterns of transmitting information throughout the organization were identified in terms of the organization as a whole, in terms of vertical dissemination within functional activities, and in terms of horizontal transmission within the various supervisory levels of each organization.